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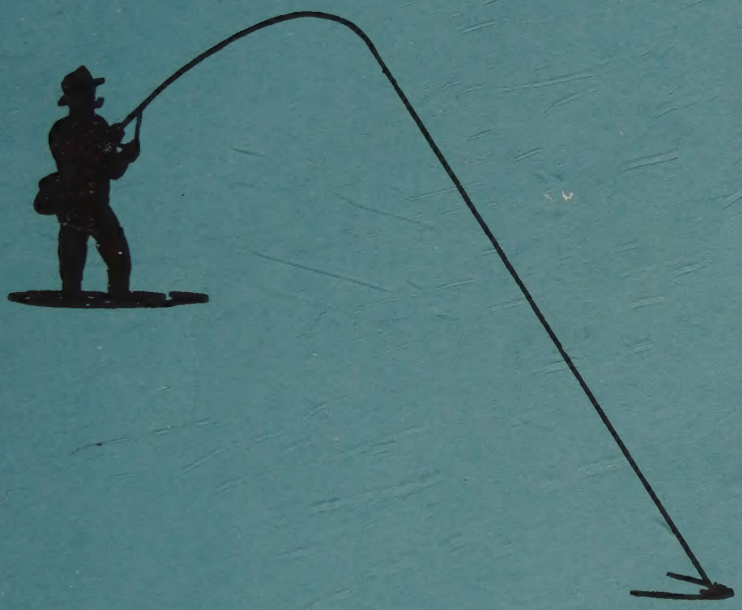

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Sport Fishery Abstracts

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of papers on limnology, ecology, natural history and other fields of specialization will be included when the subject has application to the conservation of sport fish and the restoration of sport fishing.

One volume consisting of not more than four numbers will be issued each year. Each number contains separate Author and Subject indexes, with the final number of each volume containing cumulative indexes.

The last number of each volume contains a list of publications screened for appropriate material. Suggestions for improving the usefulness and coverage of Sport Fishery Abstracts are solicited.

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Prepared in the Branch of Federal Aid
S. E. Jorgensen, Chief
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2296. Clark, Eugenie. 1959. FUNCTIONAL HERMAPHRODITISM AND SELF-FERTILIZATION IN A SERRANID FISH. Science, Vol. 129, No. 3343, pp. 215-216.

Each mature individual of Serranellus subligarius, regardless of size, has at the same time both motile sperm and eggs. Embryos and larvae were produced from artificial fertilizations and from isolated fish kept in aquaria. Mating behavior of pairs and groups of hermaphrodites shows two types of behavioral patterns involving different color changes. (Auth. abst.)

2297. Yashouv, A. 1958. ON THE POSSIBILITY OF MIXED CULTIVATION OF VARIOUS TILAPIA WITH CARP. Bamidgeh, Vol. 10, No. 2, pp. 21-29.

Largest incremental yields of carp were obtained with Tilapia nilotica stocked at a rate of 62 per dunam and with T. galilaea at a rate of 125 per dunam; these yields were greater than those obtained from the control ponds containing carp alone. It is concluded that a mixed population more efficiently exploits the possibilities of development in a pond.

2298. Sarig, S., and M. Lahav. 1958. THE TREATMENT WITH LINDANE OF CARPS AND FISHPONDS INFECTED WITH THE FISH-LOUSE ARGULUS. Bamidgeh, Vol. 10, No. 2, p. 21.

The possibility of mass disinfection of carps heavily infested with the fish-louse, Argulus, was tested. The convenient use of Lindane as a disinfectant because of the wide difference between lethal concentrations to Argulus and carp was proved.

Suitable results were obtained by disinfection of carp crowded in tanks and by extermination of the parasite by spraying fishponds. (Auth. abst.)

2299. Kilby, John D., Edward Crittenden, and Lovett E. Williams. 1959. SEVERAL FISHES NEW TO FLORIDA FRESHWATERS. Copeia, No. 1, pp. 77-78.

Four sunfishes, the white bass and the yellow perch have been taken recently from the freshwaters of western Florida and deserve inclusion in the Florida list. The shortnosed sturgeon from eastern Florida re-establishes an old record long considered by many as doubtful. Specimens are catalogued in the University of Florida Collections.

2300. Newman, H. William. 1959. OBSERVATIONS ON AGGRESSIVENESS IN SOCKEYE SALMON SMOLTS. Copeia, No. 1, p. 76.

Juveniles usually exhibit strong schooling behavior. However, individuals developed a territorial defense behavior if left overnight in a chambered tank. When returned to a larger tank with several other fish, they again schooled. Aggressive behavior was strengthened by lengthening time spent in a chambered tank. Effects of this behavior in studies involving small numbers of fish, must be taken into account.

2301. Haven, Dexter S. 1959. MIGRATION OF THE CROAKER, MICROPOGON UNDULATUS. Copeia, No. 1, pp. 25-30.

In 1949 and 1950, 1,340 Petersen disc tags and 180 internal belly tags were used to tag croakers in Chesapeake Bay and North Carolina. Returns from ocean tagging with Petersen disc tags were poor, and no returns of belly tags were obtained. Most fish were tagged near the mouth of the York River; about 10 percent of these were returned by commercial and sport fishermen.

Tag recoveries indicate movement of croakers up the estuaries and up the Bay during spring, limited random movement in summer, and an oceanward migration in fall. Distances traveled were greatest during spring and fall and minimum in August. Croakers tagged off the Maryland-Virginia coast in fall migrated to waters off the North Carolina coast. No tags attached in North Carolina waters were recovered in the Chesapeake Bay region.

More tags were recovered from pound nets than from haul seines, although haul seines captured more croakers during 1950. Croakers for tagging were obtained from pound nets and released in the same area, making them especially vulnerable to recapture in this gear. Also, the greater effort exerted by pound nets in spring reduced the number of tags available for capture by other gear.

In 1950, the sport fishery captured almost as many tagged croakers as the haul-seine fishery. This suggests that the total quantity of croakers captured by sport fishermen must be very large and may have approached three million pounds in that year. (Auth. summ.)

2302. Williams, George C. 1959. OVARY WEIGHTS OF DARTERS: A TEST OF THE ALLEGED ASSOCIATION OF PARENTAL CARE WITH REDUCED FECUNDITY IN FISHES. Copeia, No. 1, pp. 18-24.

Large fish lay more eggs than small fish, and those that lay small eggs lay larger numbers than those that lay large eggs. It has also been claimed that species that display parental care lay fewer eggs than those that leave their eggs unattended. This decreased fecundity associated with parental care is presumably independent of the effects of egg size and maternal size. So the effect of parental care should be sought in some factor independent of egg size or absolute body size. The ratio of ovary weight to body weight is such a factor. The literature does not indicate any reduction of relative ovary weight in egg-guarding species, and my observations on four species of darters showed that the two egg-guarding species had greater relative ovary weights than the two that desert their eggs. I conclude that the evolutionary development of egg-guarding behavior does not entail a reduction in fecundity. (Auth. summ.)

2303. Parker, Richard A., and Arthur D. Hasler. 1959. MOVEMENTS OF SOME DISPLACED CENTRARCHIDS. Copeia, No. 1, pp. 11-18.

During 1955--1957, largemouth bass and other sunfishes were fyke netted from three northern Wisconsin lakes, marked, displaced to a central point, and released. The annual percentage of recaptures which returned to the eight sites or original capture combined ranged from 27.7 to 46.1. The percentage of return to the original sites of capture was usually unaltered by season, size of individuals, and multiple recaptures. On the other hand, bass which were at large longer than 14 days before initial recapture ordinarily returned more successfully than those at large for shorter periods.

Curvilinear functions were used to summarize the distribution of marked individuals after displacement. It was shown that large parts (61.6 - 82.6 percent) of these populations were being recaptured in a nearly random manner. Those fish which did return to the original site of capture apparently did so in an indirect way, i.e., by searching for the area along the shore rather than going directly from the center.

A modified Petersen-type population estimate is proposed for specified conditions of sampling and nonrandom movement of marked fish. (Auth. summ.)

2304. Suttkus, Royal D. 1959. NOTROPIS URANOSCOPUS, A NEW CYPRINID FISH FROM THE ALABAMA RIVER SYSTEM. Copeia, No. 1, pp. 7-11.

A taxonomic description.

2305. Cromwell, Townsend, and Edward B. Bennett. 1959. SURFACE DRIFT CHARTS FOR THE EASTERN TROPICAL PACIFIC OCEAN. Bulletin, Vol. III, No. 5, Inter-American Tropical Tuna Commission, La Jolla, California, 20 pages.

For the region of the Eastern Tropical Pacific Ocean between 0° and 30°N, and between 120°W and the coastline of the Americas, charts of surface drift are presented for each month of the year.

2306. Hashimoto, Kanehisa, and Fumio Matsuura. 1959. COMPARATIVE STUDIES ON TWO HEMOGLOBINS OF SALMON. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 9, pp. 724-729. (In English)

Two hemoglobins (component F and S) were found in blood of chum salmon, the ratio of these in amount being almost constant (component F 55 to component S 45). Component F and S were separated from each other by means of starch electrophoresis and some properties were compared with each other. Component S is less anionic electrophoretically, more soluble in phosphate buffer, more resistant to heat coagulation, and moved slower in column chromatography than component F. The near ultraviolet spectra of component F shift towards longer wave lengths than those of component S. (Auth. summ.)

2307. Hashimoto, Kanehisa and Fumio Matsuura. 1959. MULTIPLE HEMOGLOBINS IN FISH. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 9, pp. 719-723. (In English)

Electrophoretical results show that multiple hemoglobins occur in the blood of some fishes such as yellowtail, salmon, trout, and carp. The heterogeneity of salmon hemoglobin was further confirmed in tests of solubility, heat stability, and chromatographic behavior. (Auth. summ.)

2308. Mitani, Fumio. 1959. ON THE SPAWNING SHOALS OF THE YELLOWTAIL, SERIOLA QUINQUERADIATA T. AND S., MIGRATING TO THE DANJO ISLANDS IN THE EAST CHINA SEA. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 9, pp. 708-713. (In Japanese with English abstract)

In the present paper are considered some characteristics of the shoals of the yellowtail, Seriola quinqueradiata T. and S., which are migrating to Meshima Fishing Ground around the Danjo Islands in the East China Sea off Nagasaki, Japan. The author has based these characteristics on the close examination of the gonads of the fish caught in April and May, 1958, as yellowtail are then in season in that locality. The region around the Islands is oceanographically interesting to us for its high temperature with a narrow annual range and its high transparency ranging from 15 to 30m. The author can safely conjecture that the fish which migrate to the fishing ground just referred to between mid-April and early May are ready to spawn, judging from their fully ripe gonads, though most of the fish are medium-sized ones ranging from 70 to 85cm in fork length, or from 4.9 to 9.7 kg in body weight. Eggs spawned in the region may go up north carried by the Tsushima Current and grow up to be the resources in the Japan Sea. But larger fish more than 85cm in length, or over 9.7 kg in weight, which are caught early in the season in the same fishing ground, are found to be 'immature', so far as the maturity grade of their gonads is concerned. They may migrate down to the south for spawning, and the greater part of the eggs spawned there may drift with the Kuroshio Current, adding finally to the resources in the Pacific. As for smaller fish ranging from 60 to 70 cm in length, or from 3.4 to 4.9 kg in weight, they do not spawn in the same fishing ground, but go up north after mid-May. Their eggs spawned there may increase the resources in the Japan Sea. (Auth. abst.)

2309. Mitani, Fumio. 1958. STUDIES ON THE GROWTH AND AGE OF THE YELLOWTAIL, SERIOLA QUINQUERADIATA T. AND S., FOUND IN JAPAN AND THE ADJACENT REGION. I. A FUNDAMENTAL CONSIDERATION ON AGE ESTIMATION BY VERTEBRAE. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 8, pp. 626-631. (In Japanese with English Abstract)

The present paper is the first installment of the author's work on the age estimation of the yellowtail, Seriola quinqueradiata T. and S., dealing with a fundamental character of the vertebrae in estimating the age of fish. The author has used for his experiments two different groups of 20 fishes measuring 20 cm and 80 cm in fork length, respectively,

which were caught in Wakasa Bay during the period between July, 1957 and January, 1958. The vertebral column of the fish consists of 11 abdominal, and 13 caudal vertebrae, generally 24 in all. Each centrum of the column is measured in three parts. The results obtained are as follows:

There is no marked difference in coefficient of variation in the sequence of centra, excepting the first and the last several ones which vary considerably. The relative size of each centrum is represented by the ratio of its longitudinal length (T) to that of the first centrum. It is obvious to us that the centra from the 7th to the 20th vertebra are larger in T and R (distance from apex of cone to margin) than those of the rest, particularly so in those of the four caudal vertebrae from the 15th to the 18th, and that there is no marked difference in D (vertical diameter) among the centra, excepting those of the few smaller vertebrae of the caudal end.

Significant difference is seen in the growth rate of the centrum in the sequence of the vertebra. The growth rate of the centra of the first and the last two or three vertebrae is lower than the average value of all the 24 vertebrae, but the value of the centra in the middle part of the column is higher than the average value, the value of the seven centra from the 13th to the 19th vertebra being especially higher.

In order to clarify the degree of similarity in the mode of ring formation among the centra of the fish, the author has examined by means of F-distribution method whether the relation between R and r_i (radius of each ring) is linear or not, and found that the linearity between the two is efficient enough to be a means for the age estimation of the fish.

From these facts, we may conclusively say that, in estimating the age of a fish in general through its vertebrae, as many centra as possible must be examined. If it is found very difficult to do so in case of the yellowtail, those vertebrae from the 15th to the 18th had better be used for the purpose, because they have the following characteristics, not only advantageous but also necessary for work of this kind: 1) clear ring mark, 2) large centrum, 3) small coefficient of variation in size of centrum, 4) high growth rate of centrum, and 5) great similarity of ring mark among the centra. (Auth. abst.)

2310. Nakagome, Jun. 1958. PERIODICAL CHANGES OF FISHING CONDITION AND BODY-LENGTH FORMATION, RELATIONS BETWEEN BOTH CHANGES, AND THE BETWEEN NORTHERN AND SOUTHERN FISHING AREAS OF BIGEYE TUNA AROUND MIDWAY, HAWAII, MARSHALL AND FANNING ISLANDS. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 8, pp. 622-625. (In Japanese with English abstract)

Fishing condition (rate-of-catch) in three sub-areas, A, B, and C, changes periodically; in the northern sub-areas, A and B, the good fishing season is from December to February while in the southern sub-area, C, the good fishing period lasts from December up to June.

Fork-length composition (fork-length frequency) in sub-areas A, B, C, and D changes periodically. In sub-areas A and B, young fish occupy most of the frequency from December to March in odd years, small-sized fish do so from December to March in even years, and large-sized fish do so from April to November. In sub-areas C and D, medium-sized fish are dominant from July to December and so are large-sized fish from January to June. For the most part, small-sized fish are most numerous in a period of good fishing and large-sized fish in a period of poor fishing in sub-areas A and B. Large-sized fish are most numerous in a period of good fishing and medium-sized fish in a period of poor fishing in sub-area C.

It is presumed that the fish group that has been spawned and has grown in sub-areas C and D is recruited to small-sized fish groups in sub-areas A and B, small-sized fish groups in sub-areas A and B are recruited to medium-sized fish groups in sub-areas C and D, and large-sized fish groups in sub-areas A and B and those in C and D interchange with each other. (Auth. abst.)

2311. Yasuda, Hideaki. 1958. IMPLICATIONS OF THE SCALE RING.--I. THE PHENOMENON OF UNFORMED RINGS ON THE SCALES. Bulletin of the Japanese Society of Scientific Fisheries. Vol. 24, No. 8, pp. 613-615. (In Japanese with English abstract)

With Carassius carassius having been kept for a long time in deficient nutrition, it was found the scale ring formation in such a state never proceeds in a regular manner, the position and the number of rings varying widely according to the site of the scale on body surface. Structural design appeared not different from the central place of a scale and that of usual regenerated scales except for some cracks radiating to the scale edge. These abnormal scales are considered to grow in a peculiar manner, unlike the ordinary regenerated ones, and named by the author as "dissolved scales". Comparing the fish body length calculated from the size of scale with the actual body length frequently measured during the lapse of 2-4 years, it was ascertained that the experimental fish did grow in size without any formation of the year ring. (Auth. abst.)

2312. Kobayasi, Hisao and Toru Hayasi. 1958. PRELIMINARY STUDIES ON SCALE ARRANGEMENT OF JAPANESE FISHES. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, Nos. 6 and 7, pp. 416-421. (In Japanese with English abstract)

Scale arrangement of 98 species of Japanese fishes is studied in this paper with the following results. (1) Scale arrangement can be classified into 5 types, viz., overlapped, mosaic, separated, irregular and single-lined. (2) Among overlapped-types of arrangement, a standard one consists of a set of 7 scales, varying in number from 9 to 11, 13, and anomalously from 8 to 10, 12. (3) One scale

in no case is overlapped by over 13 scales. (4) A set of 2-6 overlapped scales is in no case arranged regularly in the large part of the side of a fish. (5) Systematically related fishes usually have a similar type of arrangement, but some of them have not. (Auth. abst.)

2313. Hatanaka, Masayoshi, Masao Takahashi, and Goro Murakawa. 1958. EXPERIMENTAL STUDIES ON THE FEEDING HABITS OF AMBER-FISH, SERIOLA QUINQUERADIATA T. et S. Bulletin of the Japanese Society of Scientific Fisheries, Vol. 24, No. 4, pp. 251-255. (In Japanese with English abstract)

The feeding habits of the amber-fish, Seriola quinqueradiata, were analyzed basing on the feeding experiments and the results were studied comparatively with those of the mackerel, Pneumatophorus japonicus.

The amber-fish showed a diurnal rhythm in the feeding activity, taking food (the living saurel) quite actively in the early morning and also in the evening, and no food at midnight. When the amber-fish were reared together with the mackerel in the same pool, there always revealed an order of feeding, showing a superior behavior of the amber-fish against the mackerel. The prominent difference in growth rate between the amber-fish and the mackerel was discussed from the experimentally obtained relation between the feeding and the growth, and the rapid growth was attributed mainly to the better anabolic rate and the less maintenance ration of the amber-fish than the mackerel. (Auth. abst.)

2314. Leech, F. B., and M. J. R. Healy. 1959. THE ANALYSIS OF EXPERIMENTS ON GROWTH RATE. Biometrics, Vol. 15, No. 1, pp. 98-106.

A method is presented for the analysis of experiments in which successive measurements of the same quantity on the same organism are made at equal intervals of time. The specification and estimation of treatment effects are discussed and the method is applied to an experiment on the growth rate of pigs. (Auth. summ.)

2315. Sheps, Mindel C. 1959. AN EXAMINATION OF SOME METHODS OF COMPARING SEVERAL RATES OR PROPORTIONS. Biometrics, Vol. 15, No. 1, pp. 87-97.

Quantitative comparisons of relative frequencies, such as the mortality rates observed in several samples, are often required either as purely descriptive statistics or as estimates of population parameters. As a rule such rates are compared by calculating the ratio of two mortality rates, the ratio of two survival rates, or the difference between the two mortality or survival rates.

These statistics have been analyzed in the light of several models. Model 1 applies to the study of different populations with independent probabilities p_i of the defined event. The numerical value of a ratio depends completely on which cells are selected for the comparison. The difference is unaffected by the choice of the investigator and has several other advantages.

An alternative model (Model 2) with numerical examples, was suggested for the common situation where the factor being investigated is assumed to modify the reaction of the population in one direction only. Under this model the expected rates in the several samples are not independent. As a result, the difference is a product of two probabilities; the ratio between one set of rates is compounded of several probabilities; while the ratio between the complementary set of rates is the estimate of a single probability. When a deleterious effect is expected, the ratio of success rates is an estimate of the diminished chance of "success" or survival; and when a beneficial effect is expected the diminished risk of failure is estimated by the ratio of "failure" or mortality rates.

Several different modifications of the model were indicated for the case with more than two samples. Maximum likelihood estimates of the parameters and their variances were given. (Auth. summ.)

2316. Maeda, Tatsuaki. 1959. STUDY ON THE SALMON FISHING GROUNDS IN THE NORTH PACIFIC OCEAN. Bulletin of the Faculty of Fisheries Hokkaido University, Vol. 9, No. 4, pp. 268-282. (In Japanese with English abstract)

Studies on the salmon fishing grounds in the North Pacific Ocean have been carried on by the mother ships except in the area south of the 46°N latitude. The author investigated sea condition, fish movement, etc., in the area south of 46°N from May to July, 1956.

The results obtained may be summarized as follows: (1) The area around 167°E is found to be the mixture point of cool water which flows south along the Kamchatka Peninsula from the Bering Sea, the Kuroshio Current, running eastward and its two branches flowing north around 160°E, 170°-180°E. Consequently this area provides good fishing. (2) Dog salmon appear at first in this area in May, then red salmon follow and become abundant in quantity in late May. Lastly pink salmon appear and gather in the middle of June. (3) The southern limits of distribution of red salmon are around 43°N in early May at 6°C water temperature. In middle and late May, they appear around 45°N then arrive at 46°N in June. (4) Dog salmon migrate widely as compared with red salmon. The southern limits of distribution of dog salmon are around 42°N in early May. In the middle and late May, they appear around 45°N and then arrive at 46°N in June. (Auth. abst.)

2317. Karohji, Kohei. 1959. REPORT FROM THE "OSHORO MARU" ON OCEANOGRAPHIC AND BIOLOGICAL INVESTIGATIONS IN THE BERING SEA AND NORTHERN NORTH PACIFIC IN THE SUMMER OF 1955. IV. DIATOM ASSOCIATIONS AS OBSERVED BY UNDERWAY SAMPLINGS. Bulletin of the Faculty of Fisheries, Hokkaido University, Vol. 9, No. 4, pp. 259-267.

The distribution of diatoms in the surface

waters of the Bering Sea and the northern North Pacific was observed from materials obtained by underway samplings on the "Oshoro Maru" cruise in the summer of 1955. Oceanic populations are prevalent in Kurile waters and in the westernmost part, central part, and on the eastern shallow shelf of the Bering Sea. Neritic populations are observed in the western part and north-central part of the Bering Sea, east of southern Kamchatka, and on the coast of Alaska Peninsula in Bristol Bay. Mixed associations of oceanic and neritic forms are found in the western Aleutian waters. The greater part of the northern North Pacific is also occupied by cold oceanic diatom associations. Warm water forms of Hyalochaete and several other warm water species are prevalent west of longitude 159°E. However, Nitzschia associations are found in a certain isolated place, indicating the invasion of cold water. (From auth. summ.)

2318. Rees, Gwendolen, 1959 DITRACHYBOTHRIDIUM MACROCEPHALUM GEN. NOV., SP. NOV., A CESTODE FROM SOME ELASMOBRANCH FISHES. Parasitology, Vol. 49, Nos. 1, 2. pp. 191-209.

Ditrachybothridium macrocephalum gen. nov., sp. nov., is described. The systematic position is discussed and the species compared with species of the genus Echinobothrium to which it seems to be fairly closely related. (Auth. summ.)

2319. Erasmus, David A. 1959. THE MIGRATION OF CERCARIA X BAYLIS (STRIGEIDA) WITHIN THE FISH INTERMEDIATE HOST. Parasitology, Vol. 49, Nos. 1, 2, pp. 173-190.

Studies, using serial sections and a method of numerical assessment of the numbers of cercariae in the various tissues, have shown that cercarial entry occurs through the skin at any point along the length of the fish (prevalent host is three spined stickleback) and also through the gills and pharynx in the head region. The distribution of penetration along the length of the body is not uniform but exhibits a marked concentration in the head region.

As the time after infection increases, this initial unimodal distribution is maintained and becomes even more restricted. Nearly all the cercariae have localized in the eye 12-24 hrs. after infection. The few that remain outside the eye after this period appear to be moribund and undergoing phagocytosis.

The majority of migrating cercariae are present in connective tissue and muscle. Very few occur in the blood system and even fewer in the other organs of the body. The numbers in the blood system show a local anterior concentration in the blood vessels anterior to the heart and in the region of the gills. It seems probable that the blood system does not form the major route of migration.

Entry into the eye may occur at any point. No cercarial migration causes extensive tissue damage, but this is fatal only when major blood vessels are perforated and severe internal haemorrhage results. Interference with the nervous system and lateral line system may be the cause of the orientation disturbances which are sometimes noted within 12 hrs. after infection.

It is suggested that migration through the tissues is achieved mainly by the action of the anterior spination and that the function of the penetration gland cells may be lubricatory and/or adhesive rather than lytic.

The restricted tissue distribution during migration and the retention of an essentially unimodal distribution of cercariae along the length of the body throughout the whole period of migration suggest that localization in the lens is not achieved by chance migration. (Auth. summ.)

2320. Jain, S. L. 1959 MONOGENEA OF INDIAN FRESHWATER FISHES. VIII. SPROSTONIA, A NEW GENUS OF FRESHWATER TETRAONCHINAE, WITH THE DESCRIPTIONS OF FOUR NEW SPECIES, FROM THE GILL FILAMENTS OF FISHES, FROM LUCKNOW. Parasitology, Vol. 49, Nos. 1, 2, pp. 153-168.

A new genus, Sprostonia, is erected in the Family Dactylogyridae, subfamily Tetraonchinae, from the study of trematodes of some Indian freshwater fishes, from Lucknow, India. The new genus differs from allied genera by the characteristically two-piece shape of the ventral bar, the articulation of the cirrus and accessory piece together at the base and the presence of a dextral vagina. The genotype S. indica sp. nov. was recovered from the gills of Eutropiichthys vacha. Three other new species, S. wallagonia, S. gomtia and S. asiatica, were also recovered from other Indian fishes and assigned to the new genus. The test is illustrated with twenty-one camera lucida figures and is followed by a key to the species of the new genus, Sprostonia. (Auth. summ.)

2321. Grainger, J. N. R. 1959. THE IDENTITY OF THE LARVAL NEMATODES FOUND IN THE BODY MUSCLES OF THE COD (GADUS CALLARIAS L.). Parasitology, Vol. 49, Nos. 1, 2, pp. 121-131.

Larval nematodes occurring in cysts in the body musculature of Icelandic cod have been identified as belonging to Porrocaecum Raillet and Henry, 1912 (subgenus Terranova Leiper and Atkinson, 1914), probably P. decipiens Krabbe and Anisakis Dujardin, 1845. Identification was made possible by rearing them in vitro to the pre-adult condition. The experiments show that the following conditions are necessary for the moult to the pre-adult state; (1) a fairly high culture temperature (37°C.); (2) the presence of pieces of fish for 24 hrs. towards the beginning of the culture period. One percent pepsin, while it assists the hatching from the cysts, is not essential for the moult to the pre-adult condition. Experiments indicate that the moult takes place 3-5 days after fish has been supplied.

The larvae and pre-adults of both genera are described. Samples of larvae from cod from Greenland and the Barents Sea probably consist only of Porrocaecum and Anisakis, but a sample from

West Scotland contained only Porrocaecum. The significance of the moult to the pre-adult state is discussed. (Auth. summ.)

2322. Phillips, John. 1956-57. ASPECTS OF P^{32} METABOLISM IN LAKES. Proceedings of the Nova Scotian Institute of Science, Vol. 24, Part 3, p. 336.

The problem with which this work is ultimately concerned is the assigning of productivity indices to lakes. The rate of exchange of radiophosphate between mud and water in artificial systems of eight Nova Scotian lakes under oxidized and reduced conditions, with and without bacterial activity, is observed. Bacteria rather than mud potential appear to be the controlling factor of P^{32} concentration in lake waters. This control is effected by a rapid uptake of radiophosphate by bacteria and conversion to organic radiophosphorus. A study of the importance of aquatic plants versus bacteria on the quantities of P^{32} in lake waters indicates bacteria again are most important. (Auth. abst.)

2323. Kusa, Mamoru, and Tsuguyasu Wada. 1959. X-RAY DIFFRACTION PATTERNS FROM THE EGG MEMBRANE OF THE EGG OF THE BROOK TROUT. Nature, Vol. 183, No. 4658 (February 7, 1959), p. 410.

It has been suggested that water-hardening of the egg membrane at time of fertilization is a "special case of the reorganization of a protein molecule to form a keratin-like substance." Contrary to expectations, X-ray diagrams of egg membranes undergoing activation gave no evidence of keratin; no significant difference between activated and unfertilized egg membranes was found.

2324. Tisdall, A. L. 1959. CHEMICAL CONTROL OF EVAPORATION IN AUSTRALIA. Journal of Soil and Water Conservation, Vol. 14, No. 1, pp. 21-25.

Treatment of reservoirs up to two acres in size with cetyl alcohol is well established, equipment including dispersion floats being available commercially. Saving in evaporation theoretically should be about 55 percent but in practice amounts to about 25 percent. By using cetyl alcohol in a solvent, a satisfactory film was maintained for over 3 months on a 930-acre reservoir.

To be effective, hexadecanol must conform to the following standards as outlined by the Common - wealth Scientific and Industrial Research Organiza - tion:

Hexadecanol	Not less than 80 percent
Octadecanol	Not more than 10 percent
Tetradecanol and dodecanol	Not more than 5 percent
Alcohols of chain length less than 10	Not more than 0.5 percent
Unsaturated alcohols	Not more than 4 percent
Iodine value	Less than 3
Acid value	Less than 0.3
Saponification value	Less than 0.5
Hydroxyl value	225 to 230
Melting point	47° to 50°C.

2325. Schoffman, Robert J. 1959. AGE AND RATE OF GROWTH OF THE BLUEGILLS IN REELFOOT LAKE, TENNESSEE, FOR 1950 AND 1958. Journal of the Tennessee Academy of Science, Vol. 34, No. 1, pp. 73-77.

The study of age and growth of bluegills extended over a period of 21 years. During this period a change in growth rate has slowly occurred. Since 1947, the length and weight by age groups has slowly decreased. Commercial fishing regulations for bluegill and other species became more restrictive during this period until, in 1955, commercial fishing was abolished.

Length and weight data are presented for 177 bluegill caught by commercial and sport fishermen in 1950, and 550 bluegill caught by sport fishermen in 1958.

Age Group	No. of Fish	1950 Average Length Inches	Average Weight Ounces
2	5	5.40	2.80
3	22	6.47	3.95
4	73	7.25	5.53
5	64	7.65	6.41
6	13	8.84	8.46
		1958	
2	38	6.90	2.74
3	97	6.73	3.67
4	206	7.14	5.13
5	142	7.71	6.36
6	67	8.20	8.05

2326. Bardach, John E. 1959. THE SUMMER STANDING CROP OF FISH ON A SHALLOW BERMUDA REEF. Limnology and Oceanography, Vol. 4, No. 1, pp. 77-85.

Repeated estimates of reef fishes by visual counts were made on a shallow isolated Bermuda reef with a surface of approximately one hectare (2.5 acres). A standing crop of 490 kg was found in midsummer.

Comparisons between the fish fauna of this reef and more extended reef areas indicate that carnivorous reef fishes predominate on isolated reefs, while herbivores become more prevalent on large browsing areas. Available information on the yearly growth rates of Bermuda reef fishes suggests a relatively high overall efficiency of utilization of incident solar energy (ca. 0.0014%). The similarity of isolated reefs to ponds is discussed. (Auth. abst.)

2327. Lund, J. W. G. 1959, A SIMPLE COUNTING CHAMBER FOR NANNOPLANKTON. Limnology and Oceanography, Vol. 4, No. 1, pp. 57-65.

A simply made, cheap chamber for counting nannoplankton is described with detailed instructions for maintenance, use, and testing its accuracy. If

certain precautions are taken the results of counts made therein are distributed according to the Poisson series. The chamber itself is simply a rectangular tube. (Auth. abst.)

2328. Curl, Herbert, Jr. 1959. THE ORIGIN AND DISTRIBUTION OF PHOSPHORUS IN WESTERN LAKE ERIE. Limnology and Oceanography, Vol. 4, No. 1, pp. 66-76.

The phosphate phosphorus distribution in western Lake Erie in May 1951 and the average concentration throughout 1950-1951 are shown to be a result of the drift current pattern and the discharge of the Maumee and Detroit Rivers. The bed rock in the lake appears to provide negligible quantities. The Detroit River supplies 405 metric tons per year at an average concentration of 2.6 μg PO_4-P/L, and the Maumee River supplies 125 tons at an average concentration of 43 μg PO_4-P/L. The remaining streams supply 39 tons at a concentration of 16 μg PO_4-P/L. There is a loss of soluble phosphorus, possibly as precipitating ferric phosphate and by adsorption onto ferric hydroxide. The bottom sediments are considerably enriched in phosphorus.

Phosphate phosphorus and turbidity in the lake are positively correlated (r= +0.65), and evidence from turbidity data indicates that the lake is enriched by a thin-layered tongue of water from the south shore streams which flow over or under the clearer, nutrient poor water, and then mixes vertically with it.

Removal of fish by man accounts for an annual loss of 29 metric tons, or six percent of the average annual input of phosphorus. Approximately 94 metric tons, 20 percent of the average annual input, may be held temporarily as phytoplankton.

Although phosphorus is probably never limiting in the southern waters of western Lake Erie, the accompanying turbidity sometimes prevents any significant phytoplankton growth. (Auth. abst.)

2329. Farris, David A. 1959. A CHANGE IN THE EARLY GROWTH RATES OF FOUR LARVAL MARINE FISHES. Limnology and Oceanography, Vol. 4, No. 1, pp. 29-36.

The growth curves (age on length) of four widely diversified species of fish larvae (Sardinops caerulea, Pleuronichthys verticalis, Tetragonurus cuvieri, and Trachurus symmetricus) were divided into three sections: A, B, and C. Growth in Section A is very rapid but of short duration. Growth in Section B is much slower but of longer duration. Section C follows absorption of yolk materials and chronicles the rate at which the larvae metabolize themselves. The growth curves for several other species of fish derived from data given in the literature are generally in agreement with those derived by more rigorous analysis. The slopes of Section A were compared with Section B for each fish. These ratios lie between 4 and 10. The effect of non-logarithmic growth of larval survival is discussed. (Auth. abst.)

2330. Comita, G. W., and G. C. Anderson. 1959. THE SEASONAL DEVELOPMENT OF A POPULATION OF DIAPTOMUS ASHLANDI MARSH, AND RELATED PHYTOPLANKTON CYCLES IN LAKE WASHINGTON. Limnology and Oceanography, Vol. 4, No. 1, pp. 37-52.

The development of a Diaptomus ashlandi population and the simultaneous phytoplankton cycles in Lake Washington, Seattle, were studied in samples taken from October 1949 to October 1950. The lake is 8762 ha in area and 65.2 m deep in its deepest part. Temperature measurements showed that stratification began late in March, and the surface maximum of 22.2°C occurred late in August. Typically the epilimnion was 10 m deep, the thermocline 10 m, and hypolimnion 40 m. Chemical determinations showed the lake to be slightly alkaline usually, but during the summer months the pH was above 8.0. Alkalinity ranged from 0.246 to 0.524 milliquivalents/liter. Phosphate determinations showed a winter maximum and summer minimum in the surface and 15 m water, with an accumulation in the bottom waters as summer progressed. Dissolved oxygen was abundant, but in the hypolimnion was depleted at the rate of 2.0 mg/cm^2/month during the summer.

Cell volume and chlorophyll measurements showed that a phytoplankton bloom occurred in spring and another in late August. The taxonomic composition of these is presented.

The Diaptomus ashlandi population was found to be monocyclic. The period of greatest sexual activity was noted by counting the number of females carrying spermatophores. By this measure transfer of spermatophores lasted for approximately six months starting in January and continuing through July with the peak occurring in April, but egg production occurred from October to the following August, with the largest pulse occurring from mid-January to mid-March. These eggs developed into the nauplius stages which lasted until mid-June. Development through the copepodid stages was traced to October 28 at which time the single annual cycle was complete. Six nauplius and six copepodid stages were noted in the life cycle. The approximate time required for all the nauplii to undergo their development was 75 days. For the copepodids, I and II together required 65 days; III, 40 days; IV, 84 days; V. 90 days; and VI, 5 to 6 months. Study of separate hauls from the epilimnion and hypolimnion showed that the epilimnion was the site of most of the activity of D. ashlandi during the period of growth and metamorphosis in the summer.

A coefficient of correlation was computed for chlorophyll concentration and mean number of eggs/sac in the epilimnion. This was 0.598, which was significantly different from zero at the 1 per cent level.

Metasome measurements were made on all the copepodids. These showed that the period of maximal size for the adult females occurred from June to September 1950. This increase in size began just as the peak of phytoplankton had passed. The

summer females were found to be significantly larger than the winter females at the 1 percent level.

Study of the sex ratios showed that females were in excess for much of the year, although males were in excess for as long as 3 months (April, May, June). (Auth. abst.)

2331. Crandall, Catherine Ann, and Clarence J. Goodnight. 1959. THE EFFECT OF VARIOUS FACTORS ON THE TOXICITY OF SODIUM PENTACHLOROPHENATE TO FISH. Limnology and Oceanography, Vol. 4, No. 1, pp. 53-56.

The effects of various factors on the toxicity of sodium pentachlorophenate to the fathead minnow (Pimephales promelas) were studied. As a base for comparison of the effects of various factors, the TL_m for 24 hours was first investigated. It was found that 0.4 ppm killed all the fish, while they all lived at 0.20 ppm. The range between these two extremes was so slight that it was difficult to determine an exact 24-hour TL_m; it was found to lie between 0.32 and 0.35 ppm.

One ppm concentration of sodium pentachlorophenate was used for investigating the effect of pH on the toxicant at 18°C. It was found that the lower the pH of the test solution, the more toxic the material became. The mean survival time for 50% of the experimental animals at a pH of 5.9-6.0 was 28 $\pm$ 1.7 minutes; at 7.5-7.6, it was 80.7 $\pm$ 2.3 minutes; and at 8.9-9.0, the fish lived for 24 hours.

Temperature effects were investigated using a solution of one ppm of sodium pentachlorophenate at pH 7.5-7.6. It was found that the higher the temperature, the more toxic the sodium pentachlorophenate is to fish.

The mean survival time of 50% of the minnows at 10°C was 260.4 $\pm$ 10.2 minutes; at 18° it was 80.7 $\pm$ 2.3 minutes; and at 26° it was 46 $\pm$ 2.1 minutes. (Auth. abst.)

2332. Kleerekoper, H., and Pegronella A. Roggenkamp. 1959. AN EXPERIMENTAL STUDY ON THE EFFECT OF THE SWIMBLADDER ON HEARING SENSITIVITY IN AMEIURUS NEBULOSUS NEBULOSUS (LESUEUR). Canadian Journal of Zoology, Vol. 37, No. 1, pp. 1-8.

Hearing sensitivity was observed in Ameiurus n. nebulosus. A threshold curve over the frequency range from 210 to 1840 c.p.s. was established for normal fish as well as for fish in which the swimbladder had been mutilated. A comparison of both threshold curves indicates that the sensitivity in operated fish was decreased in the whole frequency range: for the frequencies from 330 to 750 c.p.s. by about 13 db; for the frequencies of 1000, 1300, and 1500 c.p.s. by respectively 23, 27, and 30 db. The stronger decrease at the higher frequencies was attributed to the loss or modification of the resonance of the opened swimbladder. The sensitivity of the operated fish increased in the frequency range from 330 to 210 c.p.s. This increase in sensitivity is abolished when the lateralis branch of the vagus is cut and must therefore be attributed to perception of low frequency vibrations by the lateral line. (Auth. abst.)

2333. Schiffman, R. H., and P. R. Fromm. 1959. MEASUREMENT OF SOME PHYSIOLOGICAL PARAMETERS IN RAINBOW TROUT (SALMO GAIRDNERII). Canadian Journal of Zoology, Vol. 37, No. 1, pp. 25-32.

Data on physiological parameters such as hematocrit, hemoglobin, erythrocyte count and size, organ weights, body-water weight, plasma and blood volumes are given for hatchery-raised Salmo gairdnerii. Methods for obtaining the above data using fingerlings varying in weight from 9 to 29 g are discussed. Mean values reported are as follows: hematocrit 31.8; hemoglobin 6.51 g/100 ml blood; R.B.C. count 1.11 million/mm^3; R. B. C. length 14.67 μ. Kidney, liver, and spleen weights as well as total body water, and plasma and blood volumes were found to be statistically valid factors of body weight. Straight-line regression equations are given for each. A comparison of these data with recent summaries of similar data is given and possible reasons for discrepancies are discussed. (Auth. abst.)

2334. Jackson, P. B. N. 1959. A REVISION OF THE CLARIID CATFISHES OF NYASALAND, WITH A DESCRIPTION OF A NEW GENUS AND SEVEN NEW SPECIES. Proceedings of the Zoological Society of London, Vol. 132, Part 1, pp. 109-128.

A study was undertaken of catfishes of the family Clariidae in Nyasaland, excluding that small part of the Shire River system which lies below the Murchison cataracts. Of fourteen species found, four, belonging to the genus Clarias, are not endemic and are found mainly in rivers, streams and swamps, inhabiting Lake Nyasa sparsely and only where similar conditions are found. The lake has been colonized mainly by the remaining ten species, which are all endemic to it, specialized for lacustrine conditions and sufficiently distinctive to warrant a new genus being proposed: genus Bathyclarias nov. The ten species of the genus form a species-flock, having a variety of habitats. Seven are new and are described and figured: Bathyclarias loweae, B. ilesi, B. rotundifrons, B. euryodon, B. filicibaris, B. worthingtoni and B. gigas, spp. n. Notes on distribution and ecology are given in all cases, and a key is given for all members of the family in Nyasaland. (Auth. summ.)

2335. Gauld, D. T. 1959. SWIMMING AND FEEDING IN CRUSTACEAN LARVAE: THE NAUPLIUS LARVA. Proceedings of the Zoological Society of London, Vol. 132, Part 1, pp. 31-50.

An account is given of swimming and feeding in the nauplii of Artemia, Balanus, Calanus, and Oithona, with observations on other nauplii. Previous work is reviewed.

In all cases the antennae are the principal locomotion organs. The antennules may play little or no part in locomotion and are mainly balancing organs.

In Artemia the antennae are also the chief food collecting organs. Particles are swept into the oral region by the antennal setae and then carried to the mouth by spines on the reduced mandibles.

In Balanus and most planktonic copepods, the principal food collecting appendage is the mandible; particles are swept into the oral region by its long ventral setae and passed to the mouth by spines like those of Artemia.

The nauplii of Penaeidea and Euphausiacea and Euchaeta (Calanoida) do not feed. (Auth. summ.).

2336. Lowe, Rosemary H. (McConnell). 1959. BREEDING BEHAVIOUR PATTERNS AND ECOLOGICAL DIFFERENCES BETWEEN TILAPIA SPECIES AND THEIR SIGNIFICANCE FOR EVOLUTION WITHIN THE GENUS TILAPIA (PISCES: CICHLIDAE). Proceedings of the Zoological Society of London, Vol. 132, Part 1, pp. 1-30.

The aim of this paper is to collate data from field studies on many species of Tilapia in the waters of East and Central Africa, to relate the types of breeding behaviour to the ecological background, and to try to assess the evolutionary significance of the patterns of breeding behaviour and ecological differences which emerge. Behaviour and ecological studies present complementary pictures of the interaction between the fish and its environment, and an attempt is made here to piece these together to examine the evolutionary effects of their reciprocal and complex interaction. (Auth.)

2337. Nelson, Edward M. 1959. THE EMBRYOLOGY OF THE SWIM BLADDER IN THE COMMON SUCKER CATOSTOMUS COMMERSONI (LACEPEDE). The American Midland Naturalist, Vol. 61, No. 1, pp. 245-252.

The development of the swim bladder in Catostomus commersoni is described. The swim bladder begins as a tubular diverticulum of the middorsal aspect of the anterior gut region. This tubular process becomes the primitive swim bladder with its single chamber and pneumatic duct. A second diverticulum arises from the anterior face of the primitive swim bladder chamber, just dorsal to the opening of the pneumatic duct. This process becomes the anterior chamber of the definitive two-chambered swim bladder. The development of the anterior chamber includes a transitory phase in which the lumen is partially obliterated by a loose connective tissue matrix between the outer and inner tunics. This phenomenon has been described only for cyprinid fishes. The transient inter-tunic matrix is compared to the "cardiac jelly" of the developing vertebrate heart and to the "edema" of the vertebrate uterus in its early stages of pregnancy or pseudopregnancy. The embryology of the swim bladder of this catostomid constitutes an additional character demonstrating the common relationships of the cypriniform ostariophysine fishes. (Auth. summ.)

2338. Ostdiek, John L., O. F. M. and Roland M. Nardone. 1959. STUDIES ON THE ALASKAN BLACKFISH DALLIA PECTORALIS. I. HABITAT, SIZE AND STOMACH ANALYSES. The American Midland Naturalist, Vol. 61, No. 1, pp. 218-229.

A study of some aspects of the ecology of the arctic blackfish, Dallia pectoralis, was made. Ecological studies included pH, alkalinity, temperature, oxygen content of the water, and feeding characteristics of the fish.

The pH of the water ranged from pH 6.8 to 8.0. Water temperature varied from 7.8°C to 13.2°C. Dissolved oxygen varied from 2.30 to 12.58 ppm. Ostracoda, Cladocera and larvae of Diptera were the principle food organisms, in number and frequency of occurrence. There was, however, great variability from specimen to specimen. (Auth. summ.)

2339. Swift, D. R. 1959. SEASONAL VARIATION IN THE ACTIVITY OF THE THYROID GLAND OF YEARLING BROWN TROUT SALMO TRUTTA LINN. The Journal of Experimental Biology, Vol. 36, No. 1, pp. 120-125.

Seasonal variations in the activity of the thyroid gland in yearling brown trout were measured by two methods: first, by the changes in thyroid epithelial cell height and, secondly, by the rate of loss of radio-iodine from the gland. Peak thyroid activity was found to occur in spring with a second peak demonstrable by the radio-iodine technique in midsummer. With the exception of this short burst of activity in July, the activity of the thyroid was found to be inversely proportional to the water temperature.

It is suggested that the thyroid is concerned in a temperature-compensating mechanism. It is also suggested that the rate of change of the thyrotropic hormone level in the blood determines the mode of response of the gland. (Auth. summ.)

2340. Jones, J. D. 1959. A NEW TONOMETRIC METHOD FOR THE DETERMINATION OF DISSOLVED OXYGEN AND CARBON DIOXIDE IN SMALL SAMPLES. The Journal of Experimental Biology, Vol. 36, No. 1, pp. 177-190.

A microtonometric method is described whereby tensions of carbon dioxide, oxygen, and nitrogen can be determined in fluid samples of 0.3 ml. volume or less, each determination taking 20-25 min. Replicate determinations of the tensions of carbon dioxide, oxygen and nitrogen give maximum coefficients of variability of 3.0, 2.2, and 1.2%, respectively. A comparison of the present method with a micro-Winkler method for the determination of dissolved oxygen shows a close agreement; the mean percentage difference being 3.0. (Auth. summ.)

2341. Shelton, G. 1959. THE RESPIRATORY CENTRE IN THE TENCH (TINCA TINCA L.). I. THE EFFECTS OF BRAIN TRANSECTION ON RESPIRATION. The Journal of Experimental Biology, Vol. 36, No. 1, pp. 191-202.

The effects of brain transections on the breathing movements of the tench are described.

The whole of the mid- and forebrain, and the

cerebellum, can be removed without producing any change in the breathing movements. Normal movements continue after section of the IXth and Xth cranial nerves. Transections of the spinal cord and posterior medulla are without effect on the breathing rhythm until they reach a level just behind the facial lobe. The breakdown of respiration produced by transection at this level is interpreted as being due to removal of part of the respiratory centre.

Rhythmically repeated movements in which the opercula abduct and the mouth closes are seen after transection in the posterior parts of the medulla. These movements are thought to be due to activity in neurones which are responsible for co-ordination of the coughs in the intact animal. These neurones are situated in the anterior part of the medulla, beneath the cerebellum. (Auth. summ.)

2342. Cocking, Anthony W. 1959. THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS). I. THE EFFECTS OF CONSTANT HIGH TEMPERATURES. The Journal of Experimental Biology, Vol. 36, No. 1, pp. 203-216.

The temperature at which 50% of a sample of roach die within a week cannot be raised above 33.5°C. by raising the acclimatization temperature.

The roach is about as eurythermal as the yellow perch (Perca flavescens).

The mean asphyxial concentration of oxygen at 30 and 32°C. is approximately 0.8 mg./l.

Median survival time at any lethal temperature increases with increase in acclimatization temperature; survival time for any acclimatization temperature decreases as test temperature increases; the temperature at which 50% of a sample die within a week rises by about 1°C. for each 3°C. rise in acclimatization temperature.

The behaviour, on transfer to higher temperatures, depends on the acclimatization temperature and the size of the jump in temperature and can be divided into five characteristic stages.

Dying fish develop a black pattern; myotomic swimming muscles die first and opercular muscles last. The heart was still beating when the fish were opened but the gall bladder was abnormal.

2343. Khanna, Dharam Vir. 1958. OBSERVATIONS ON THE SPAWNING OF THE MAJOR CARPS AT A FISH-FARM IN THE PUNJAB. Indian Journal of Fisheries, Vol. V, No. 2, pp. 282-290.

Observations made at the Government Fish-Farm, Batala, on breeding of carps reveal that high oxygen-tension and increased pH value are not required for fish-breeding. It has also been noticed that chemical composition of water undergoes no appreciable change during fish-breeding, and that the chemical nature of water has nothing to do with breeding. However, presence of flood-water in appreciable quantity in the breeding ground and a current of moderate intensity are prerequisite for spawning. (Auth. summ.)

2344. Cocking, Anthony W. 1959. THE EFFECTS OF HIGH TEMPERATURES ON ROACH (RUTILUS RUTILUS). II. THE EFFECTS OF TEMPERATURE INCREASING AT A KNOWN CONSTANT RATE. The Journal of Experimental Biology, Vol. 36, No. 1, pp. 217-226.

When roach were acclimatized to 20°C. and then subjected to five constant rates of temperature rise, the range of death temperatures depended on the interaction between the opportunity for acclimatization and the exposure to lethal temperatures.

At 1/20°C. an hour rise in temperature, roach acclimatized fully, died over the longest temperature range (30.3-35.8°C.), had the highest mean death temperature (32.9°C.) and died over a disproportionate length of time (up to 88 hr.) when compared with other rates. The death temperature range at 1/10°C. an hour was 30.8-32.0°C. (mean 31.4°C.) and 8/10°C. an hour was 31.5 to 32.9°C. (mean 32.9°C.). Roach cannot acclimatize fully at rates faster than 1/20°C. an hour though some acclimatization takes place at a rate of 8/10°C. an hour.

Roach excrete more ammonia as the temperature rises but the increase depends on the rate of temperature rise and is delayed for up to 240 hr. at 1/20°C. an hour.

The behavior showed characteristic changes.

Roach died from the posterior end forwards; the heart was beating and the gall bladder abnormal when the body was opened.

2345. UNDERHILL, James C., and David J. Merrell. 1959. INTRA-SPECIFIC VARIATION IN THE BIGMOUTH SHINER (NOTROPIS DORSALIS). The American Midland Naturalist, Vol. 61, No. 1, pp. 133-147.

The annual, inter-stream, intra-basin and inter-basin variation of nine meristic characters in the bigmouth shiner from the Minnesota, Mississippi, St. Croix, and Missouri Rivers in Minnesota was studied. The high level of inter-basin variation found is considered to be a reflection of the complex intra-basin variation and high annual variation. The characters studied fell into three categories, one showing little or no annual variation and inter-basin variation, a second group exhibited a high level of variation and the third an intermediate level of variation. The differences between sample averages could not be correlated with any marked atmospheric changes or ecological differences between the various streams from which the samples were drawn.

The central problem is to determine whether the various populations are "ecophenotypes" or micro-geographic races. The two alternatives are discussed in light of the present study and previous studies on fishes and other groups of organisms. The various populations of the bigmouth shiner studied are interpreted as micro-geographic races though at present it is impossible to decide from the available evidence whether meristic characters in fishes are primarily determined by the environmental complex or by the genotype. (Auth. summ.)

2346. Jerlov, N. G. 1959. MAXIMA IN THE VERTICAL DISTRIBUTION OF PARTICLES IN THE SEA.

Deep-Sea Research, Vol. 5, No. 3, pp. 173-184.

The presence of maxima in the vertical distribution of particulate matter in the sea is discussed and interpreted. Below the euphotic zone the mechanism at which a maximum is formed requires that the sinking particles are slowed up and that the eddy diffusion increases towards greater depths. The particle content in the deep sea is on an average proportional to the abundance in the upper layers of the water region. The particle distributions are much controlled by eddy diffusion and so by flow of water masses. Thus it is shown for a number of stations and sections in the oceans that a clear relationship between particle distribution and salinity distribution exists, implying that particle maxima occur in the core of the water mass. (Auth. abst.)

2347. Kriss, A. E. 1959. MICROBIOLOGY AND THE CHIEF PROBLEMS IN THE BLACK SEA. Deep-Sea Research, Vol. 5, No. 3, pp. 193-200.

Micro-organisms inhabit not only the oxygen zone but also the entire hydrogen-sulphide area of the Black Sea. Their average biomass per m^3 of water in the oxygen zone is lower than in the hydrogen sulphide region. In the latter are chiefly peculiar filamentous autotrophic forms utilizing hydrogen sulphide in their life processes. They are good indicators of the water exchange between the oxygen and hydrogen-sulphide zones of the Black Sea. At the bottom in the deep parts of the Black Sea the concentration of microbial organisms is similar to that in the mud of the Gulf of California. The use of the Black Sea, as suggested, for the disposal of the industrial radioactive wastes, if realized, would no doubt lead to dangerous consequences. Radioactive substances would be transferred in a comparatively short time via bacteria through the links of the food chains, to commercial fish. (Auth. summ.)

2348. Nielsen, E. Steemann, and V. Kr. Hansen. 1959. MEASUREMENTS WITH THE CARBON-14 TECHNIQUE OF THE RESPIRATION RATES IN NATURAL POPULATIONS OF PHYTOPLANKTON. Deep-Sea Research, Vol. 5, No. 3, pp. 222-233.

A method for measuring the rate of respiration of a phytoplankton population by means of the carbon-14 technique is described. A curve showing the rate of net photosynthesis as a function of light intensity is obtained. By extrapolation the rate of respiration is deduced.

The accuracy of the method is discussed on a theoretical as well as on an experimental basis.

From 78 measurements made during the summers of 1956 and 1957 in the North Atlantic and in the Arctic, 90 percent of all rates measured were 15 percent or less of light-saturated photosynthesis, 68 percent were 10 percent or less. In not a single case did the rate of respiration reach anywhere near the order of magnitude obtained in light-saturated photosynthesis. This was also the case with 12 similar measurements made during the Galathea Expedition, mainly in tropical waters. (Auth. abst.)

2349. Allen, George H. 1959. BEHAVIOR OF CHINOOK AND SILVER SALMON. Ecology, Vol. 40, No. 1, pp. 108-113.

Artificial runs of silver salmon (Oncorhynchus kisutch) and chinook salmon (O. tshawytscha) were established in the fall of 1951 at the University of Washington School of Fisheries with the completion of new hatchery and fishway facilities in 1950. It is simple to obtain a daily count of fish returning to the hatchery ponds, and therefore to study the physical conditions of the environment associated with the appearance of the fish in the ponds. During the fall of 1953 and winter of 1954 a total of 237 salmon were trapped at the hatchery ponds. Of these, 83 chinook salmon and 113 silver salmon were used in correlating the date of return and certain physical factors in the environment. A uniform flow of water in the fishway was maintained by a water supply taken mainly from the environment in which the salmon were resting prior to movement into ponds through the fishway. Movement of silver salmon into the ponds was correlated with nighttime rainfall. Movement of chinook salmon corresponded with periods of low barometric pressure. The movement into the ponds was analogous to movement onto the spawning beds in natural areas. The movement was considered innate behavior because all of the fish involved in the study were never conditioned to natural stream gravels. This observed behavior was discussed in terms of the recent approaches to animal behavior advocated by Tinbergen (1951), Hoar (1953), and Thorpe (1957). (Auth. summ.)

2350. Yashouv, A. 1958. WINTER CULTURE OF CARPS AT THE FISH CULTURE RESEARCH STATION--DOR. Bamidgeh, Vol. 10, No. 4, pp. 85-90.

The influence of density on individual growth under density conditions of these experiments, 68 to 260 fish per dunam, was found to have no significant effect. More significantly the winter growth of carp in ponds that had received no treatment was more or less the same as that in ponds that had received both fertilizer and supplementary feed. Apparently the limiting factor is mainly temperature.

The influence of fertilizer and supplementary feed on winter growth of carp and tilapia in mixed culture experiments was clear. The daily increase per dunam during the cold season, December through January, was 325 grams compared to 137 grams for those ponds receiving no treatment.

2351. Yashouv, A. 1958. THE EXCRETA OF CARP AS A GROWTH LIMITING FACTOR. Bamidgeh, Vol. 10, No. 4, pp. 90-95.

Conditioning of the water in aquaria by adding water from aquaria in which fish were crowded showed a definite retardation of growth. This was effective through a range of temperature throughout the year, the degree of influence dependent upon the concentration of the growth retarding material. No attempt to determine the identity of this material was made.

2352. Jones, S. 1958 NOTES ON EGGS, LARVAE AND JUVENILES OF FISHES FROM INDIAN WATERS. I. XIPHIAS GLADIUS LINNAEUS. Indian Journal of Fisheries, Vol. V, No. 2, pp. 357-361.

A post larva, collected in an ordinary surface plankton tow net from the Laccadive Sea, is described.

2353. Saha, K. C., and D. P. Sen. 1958. STUDIES ON THE MORTALITY IN SPAWN AND FRY OF INDIAN MAJOR CARPS DURING TRANSPORT. PART IV. TYPES OF CONTAINERS USED FOR TRANSPORTING SPAWN AND FRY UNDER OXYGEN PRESSURE. Indian Journal of Fisheries, Vol. V, No. 2, pp. 362-374.

For transporting the fry of Indian major carps, three types of containers, viz, glass carboy, specially designed aluminum and galvanized iron sheet containers and latex-rubber and plastic bags, have been described. Although from the point of view of efficiency the specially designed aluminum container has been found most suitable, considering the relative costs of different types of containers tried, the latex-rubber bag may be recommended for commercial use. (Auth. summ.)

2354. Yashouv, A. 1958. ACCLIMATIZATION OF NEW SPECIES IN THE FISHPONDS OF THE STATION. Bamidgeh, Vol. 10, No. 4, pp. 75-85.

This article consists of a series of short reports on growth of the grass carp, Ctenopharingodon idellus; of Catla catla; of the buffalo, Megastomatobus cyprinella; and on the mono-sex culture of Tilapia nilotica.

2355. Jerlov, N. G., and Jacques Piccard. 1959. BATHYSCAPH MEASUREMENTS OF DAYLIGHT PENETRATION INTO THE MEDITERRANEAN. Deep-Sea Research, Vol. 5, No. 5, pp. 201-204.

The penetration of blue daylight down to 300m was measured during dives with the bathyscaph Trieste south of Capri. The results show the gradual increase in daylight extinction from the surface to 100m which is typical for clear water. The transparency in the deep layers is much lower than that in clear water; it is suggested that the additional extinction is due to particles. (Auth. abst.)

2356. Wood, R. D. 1959. A NATURALLY OCCURRING VISIBLE THERMOCLINE. Ecology, Vol. 40, No. 1, pp. 152-153.

Observed in a small pond with an average depth of 12 feet while skin diving on July 24, and again on August 3, 5, 9, and 12, the thermocline consisted of a gossamer sheet 2-5 mm. thick separating the warm (79°F) rather greenish turbid water of the epilimnion and the cool (65°F) clear brownish water of the hypolimnion.

2357. Becker, E. Lovell, Robert Bird, John W. Kelly, John Schilling, Sidney Solomon, and Nelson Young. 1958. PHYSIOLOGY OF MARINE TELEOSTS. I. IONIC COMPOSITION OF TISSUE. Physiological Zoology, Vol. XXXI, No. 3, pp. 224-227.

When this investigation was undertaken, it was thought that systematic deviations in tissue ionic composition might be found and that these would reflect different adaptations to the marine environment by fish. No evidence for such deviations appears in the data which have been presented. It should be pointed out, however, that the fish examined represent only a limited number of teleost families, and perhaps an extended investigation would uncover differences. (Auth. summ.)

2358. Becker, E. Lovell, Robert Bird, John W. Kelly, John Schilling, Sidney Solomon, and Nelson Young. 1958. PHYSIOLOGY OF MARINE TELEOSTS. II. HEMATOLOGIC OBSERVATIONS. Physiological Zoology, Vol. XXXI, No. 3, pp. 228-231.

Studies have been carried out on the blood and hemocytopoietic organs of marine teleosts.

Migration of hemoglobin in an electrical field could not be detected by our methods. Serum electrophoresis revealed the absence of protein with the electrical motility of gamma globulin of mammals, with one possible exception. There were no cells morphologically resembling plasma cells in the spleen or kidneys, lending further evidence that those cells may be active in production of gamma globulin.

The results represent observations of only a limited number of teleost families, and further studies will be necessary to establish these phenomena. (Auth. summ.)

2359. Mago Leccia, Francisco. 1958. THE COMPARATIVE OSTEOLOGY OF THE SCOMBROID FISHES OF THE GENUS SCOMBEROMORUS FROM FLORIDA. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 8, No. 4, pp. 299-341.

Three species of Scomberomorus found in Florida, the Spanish mackerel (S. maculatus), the cero or painted mackerel (S. regalis) and the king mackerel or kingfish (S. cavalla) are the subject of a comparative osteological study. A brief discussion of the possible relationships within the genus and possible relations of Scomberomorus to other genera is presented.

In comparing the osteology of the three Florida species it was noted that both S. maculatus and S. regalis showed many characters in which S. cavalla stood apart. It was therefore concluded that S. cavalla was a divergent member of the genus.

It is suggested that the two Atlantic groups (cavalla and regalis-maculatus) exist on a worldwide basis, western Pacific forms (Cybium) being assignable to one or the other group. (Auth. abst.)

2360. Morrow, James E., Jr. NAMES OF THE BLUE MARLIN AND BLACK MARLIN. Bulletin of Marine Science of the Gulf and Caribbean, Vol. 8, No. 4, pp. 356-359.

Examination of type material in the British Museum (Natural History) allowed identification of older names with currently accepted species. The Atlantic blue marlin is named Makaira herschelii (Gray), dating from 1838. The Pacific black marlin is named Istiompax brevirostris (Playfair), dating from 1866. Brief diagnoses and synonymies are given. (Auth. abst.)

2361. Riegel, J. A. 1959. THE SYSTEMATICS AND DISTRIBUTION OF CRAYFISHES IN CALIFORNIA. California Fish and Game, Vol. 45, No. 1, pp. 29-50.

The systematics and distribution of California crayfishes are herein revised and brought up to date. (from auth. summ.)

2362. Wood, James W., and Erling J. Ordal. 1958. TUBERCULOSIS IN PACIFIC SALMON AND STEELHEAD TROUT. Contribution No. 25 of the Fish Commission of Oregon, Portland, Oregon, 38 pgs.

Tuberculosis in salmonoid fishes were first observed in the 1952 run of fall chinook salmon (Oncorhynchus tshawytscha) returning to the Bonneville Hatchery of the Oregon Fish Commission. In the studies reported here, tuberculosis was found not only in adult spring chinook but in silver salmon (O kisutch), blueback salmon (O. nerka), and in anadromous and resident strains of rainbow trout (Salmo gairdnerii). Advanced tuberculosis was found in salmonoid fishes held in fresh water for two years or longer, as well as in adults returning from the sea. Lesions were most frequently observed in the liver, and varied in size from small miliary tubercles to huge necrotic areas, filled with characteristic acid-fast bacilli. The typical bacilli were found in stained smears from the kidney, heart, musculature, brain, intestines, pyloric caeca, and roe of infected fish. The disease was originally observed in sexually-underdeveloped fish, and there is indication that it interferes with sexual maturation. It was found that tuberculosis in marked salmon known to be of hatchery origin was extremely high--in some cases 100 per cent. Tuberculosis was absent in the small number of silver and chum salmon examined which were known to be the progeny from natural spawning. It is suggested that dissemination of the disease may be due to fish-cultural practices such as the feeding of untreated carcasses and the viscera from tuberculous fish. Since acid-fast bacilli were found in the roe of some fish, it is also suggested that the disease may be transmitted to healthy eggs during the process of fertilization. Tuberculous adult spring chinook were found less capable of surviving to maturity after they reached the spawning grounds than were non-infected fish. It is likely that tuberculosis also influences the ability of salmon to survive during earlier stages of their life history. The incidence of tuberculosis in adult spring chinook entering the Dexter holding ponds on the Middle Fork of the Willamette River in 1955 and 1956 was 8.7 and 6.1 per cent respectively. The increase in incidence to 58.8 per cent in 1957 is attributed to the increased dependency of the run on artificial propagation necessitated by the construction of Lookout Point Dam. Among chinook caught in the Columbia River gill-net fishery in February and in May 1956, 12.3 and 10.5 per cent, respectively, of those examined were tuberculous. Although these are spring chinook, it is believed that hatchery-reared fall chinook also entered the catch, especially during May, and may have contributed to the number of tuberculous fish taken. (Auth. abst.)

2363. Webster, Dwight A., William G. Bentley, and James P. Galligan. 1959. MANAGEMENT OF THE LAKE TROUT FISHERY OF CAYUGA LAKE, NEW YORK, WITH SPECIAL REFERENCE TO THE ROLE OF HATCHERY FISH. Memoir 357, Cornell University Agricultural Experiment Station, New York State College of Agriculture, Ithaca, New York, 83 pgs.

This lake has traditionally offered poor lake trout fishing as compared with the other Finger Lakes of New York. A study was initiated in 1946 to (1) evaluate fingerlings vs. yearling plantings of hatchery-reared lake trout, (2) evaluate contributions of hatchery plantings to the total population, and (3) obtain data pertinent to the general management program for lake trout in Cayuga Lake.

In the period 1946-1954, 310,000 marked fingerlings and 73,000 marked yearling lake trout were stocked; an additional 420,000 unmarked fingerlings were also planted. A sampling program began in 1950. This consisted of fishing 500-foot gill net gangs made up of a graded series of mesh sizes. A total of 25,000 feet of netting was fished each year in a predetermined fashion in 5 sample areas of the lake. In the period 1950-1955, the mean annual sample was 236 lake trout.

Yearlings showed a fourfold higher representation in the 7-year classes adequately sampled. This superiority is not enough to offset the numerical advantages of fingerling plantings (about 4 times as many fingerlings can be reared for the same food cost and space requirements) and the additional problem of holding the fish in the hatchery for 6 months longer.

No advantage could be demonstrated for scatter-planting over spot-planting of fingerlings.

After prorating the unmarked fish in the sample on the basis of marked to unmarked fingerlings planted, it was clear that virtually all trout in Cayuga Lake were of hatchery origin. Presumably, natural spawning areas have not been adequate to maintain a successful fishery for at least the past half-century.

Judging from the annual catch in standard gangs and from angler diaries, the lake trout population is comparatively stable under current stocking. Growth rate is rapid up to age VI and a total length of about 24 inches; thereafter it diminishes rapidly, probably because of the onset of sexual maturity. A dwarf population of alewives forms the nearly exclusive food of all but the smallest trout.

Statistics derived from the catch curve based on fin-clipped fish, and corroborated by records of tagged fish, indicate a total annual survival rate after age V of 46 per cent. The voluntary return of tagged fish suggests a minimum "rate of exploitation" of about 5 per cent per year. Even assuming that fishing mortality is grossly underestimated, it appears that the annual natural mortality rate is of the order of 40 to 50 per cent.

This information suggests that Cayuga Lake could provide more fishing for lake trout. The most expedient means of doing this seems to be by increasing the length of the open season--a possibility that needs to be evaluated for the Finger Lakes as a group (Auth. summ.)

2364. Young, E. Gordon, D. G. Smith, and W. M. Langille. 1959. THE CHEMICAL COMPOSITION OF SEA WATER IN THE VICINITY OF THE ATLANTIC PROVINCES OF CANADA. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 7-12.

Samples of sea water from eight locations at the surface around the coast of the Atlantic Provinces of Canada have been analyzed for their content of major and minor chemical constituents. The salt water in the Bras d'Or Lakes of Cape Breton Island, N. S., was different from that in the contiguous Atlantic Ocean and showed evidence of much dilution. The seven other samples examined averaged 17.17 o/oo for chlorinity and 31.03 o/oo for salinity. These averages are low for open oceanic waters. The average composition of sea water for this area was as follows in grams per kilogram: Na, 9.59; K, 0.34; Ca, 0.37; Mg, 1.15; SO_4, 2.36; B as H_3BO_3, 0.0243. Concentrations of the trace elements in micrograms per litre varied within the following limits: As as As_2O_3, 1.4 to 2.0, Co, 0.33 to 0.67; Cu, 13 to 22; F, 860 to 1200; I, 6 to 53; Mo, 6.3 to 14.0; PO_4, 5 to 69; Si, 44 to 95; Zn, 6.5 to 10.9. Nickel was also present in all samples but vanadium was not detected. The various ratios of the mineral elements, especially to chlorine, have been calculated, and show only slight divergence from those for open ocean water. (Auth. abst.)

2365. Bishop, Yvonne M. M. 1959. ERRORS IN ESTIMATES OF MORTALITY OBTAINED FROM VIRTUAL POPULATIONS. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 73-90.

The bias in individual estimates of the natural mortality coefficient derived from the ratio of successive virtual populations is defined algebraically and is shown to be unchanged whether one or more year-classes is considered, if the mortality coefficients are assumed to be constant for all exploitable fish. Limiting and probable values of this bias are shown graphically for a coefficient of fishing mortality ranging from 0 to -2.0 in the year for which the estimate is obtained. These values are drawn for a true natural mortality of -0.2 and -0.4 and for both an increasing and a decreasing fishing effort. Bias in individual estimates of natural mortality is greatest when there are large fluctuations in fishing effort, particularly when fishing mortality is low relative to natural mortality, and it increases with increased natural mortality.

A linear regression of a series of virtual population ratios would in general give an intercept value which underestimated the coefficient of natural mortality, and a slope which overestimated the coefficient of fishing mortality, in situations where F has tended to increase and also where it has had no trend (the "steady state" of Table I). Both these errors would be in the opposite direction during a period when there was a decline in fishing effort. (Auth. abst.)

2366. Anas, Raymond E. 1959. THREE-YEAR-OLD PINK SALMON. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 91-94.

A specimen of Oncorhynchus gorbuscha 552 mm in fork length, taken in the Skeena River fishery in 1956, had scales indicating two years of growth completed and substantial 3rd-year growth. (Auth. abst.)

2367. Parker, Robert P., and Edgar C. Black. 1959. MUSCULAR FATIGUE AND MORTALITY IN TROLL-CAUGHT CHINOOK SALMON (ONCORHYNCHUS TSHAWYTSCHA). Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 95-106

Blood samples were analyzed for lactic acid from 66 troll caught chinook salmon after from zero to 10 3/4 hours of rest. Fish were held in a live box aboard a trolling vessel. During the course of the experiment 22 individuals died. Analysis of these data indicate a general response of blood lactic acid comparable with results of other experiments. The typical response is a gradual increase of blood lactic acid to high levels in the third and fourth hours, followed by a general decline. Death is strongly associated with high blood lactic acid. The level of lactic acid response is not significantly increased with more than 10 minutes of vigorous exercise nor is it significantly affected by the size of the fish within the ranges sampled in this experiment. Mortality rate is estimated at 71% with 95 percent binomial confidence limits of 40% and 86%. (Auth. abst.)

2368. Hewson, L. C. 1959. A SEVEN-YEAR STUDY OF THE FISHERY FOR LAKE WHITEFISH, COREGONUS CLUPEAFORMIS, ON LAKE WINNIPEG. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 107-120.

A representative section of the Lake Winnipeg whitefish fishery was studied during seven summers. The average size of whitefish in samples numbering from 300 to 3,500 fish yearly varied with time and place, but trends were absent. Ages of whitefish in commercial catches, determined by scale reading, revealed three main age groups each year during six summers. Fishing success varied during 7 years and showed no indication of a trend toward

better or worse fishing. Some parts of the fishing ground are but lightly exploited. Temperature changes in inshore water masses affected catches in some fishing gear. (Auth. abst.)

2369. Canagaratnam, P. 1959. GROWTH OF FISHES IN DIFFERENT SALINITIES. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 121-130.

Sizes attained by several species of fish inhabiting both sea and fresh waters suggest that the larger size of the marine form is due to the higher osmotic content of the medium. This theory was tested experimentally by comparing fresh and saltwater growth of juvenile coho, sockeye and chum salmon and adult goldfish. Such factors as temperature and food were rigidly controlled. In general, the salmonids (coho, chum or sockeye underyearlings) grew more rapidly in saline than in fresh water. Adult goldfish did not show any significant difference in weight increase. (Auth. abst.)

2370. Hewson, L. C. 1959. A STUDY OF SIX WINTER SEASONS OF COMMERCIAL FISHING ON LAKE WINNIPEG, 1950-1955. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 1, pp. 131-145.

Investigations of a Lake Winnipeg winter fishery for sauger, Stizostedion canadense, and yellow walleye, S. vitreum vitreum, during January and February each year revealed some significant changes in average size for two species as the season progressed, and from year to year. Average weight based on 50 to 1600 fish approximated 0.5 lb for sauger and 0.7 for walleye in most areas. Fishing success declined during the study period. A sample of the sauger catch revealed mainly age-groups III, IV and V. Fish catches appeared unrelated to either water temperatures or dissolved oxygen. Increased use of nylon nets had no apparent effect on annual production. (Auth. abst.)

2371. Hallam, J. C. 1959. HABITAT AND ASSOCIATED FAUNA OF FOUR SPECIES OF FISH IN ONTARIO STREAMS. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 2, pp. 147-173.

Four species of fish found in Ontario streams can be divided into two distinct groups on the basis of habitat and associated fauna. Salvelinus fontinalis (Mitchill) and Cottus bairdi Girard are found associated in cool source waters whereas Ambloplites rupestris (Rafinesque) and Micropterus dolomieui Lacapede occur together in warmer downstream waters. The latter group has more associated species of fish than the former. Some invertebrates such as certain stonefly and mayfly nymphs occur frequently with fish of one group and rarely with fish of the other group. They may be useful as indicators of waters likely to be inhabited by or suitable for the species of fish with which they are frequently associated. (Auth. abst.)

2372. Basu, Satyendra Prasanna. 1959. ACTIVE RESPIRATION OF FISH IN RELATION TO AMBIENT CONCENTRATIONS OF OXYGEN AND CARBON DIOXIDE. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 2, pp. 175-212.

The oxygen consumption at a steady rate of activity maintained by a mild electric stimulus was measured for Salvelinus fontinalis (Mitchill), Catostomus commersoni (Lacapede), Ameiurus nebulosus LeSueur, Cyprinus carpio (Linnaeus) and Carassius auratus (Linnaeus) in the presence of various combinations of oxygen and carbon dioxide. At a given level of oxygen the logarithm of the rate of oxygen consumption decreases linearly with the concentration of carbon dioxide. The linear relation so found is characteristic of a given species and the sensitivity to carbon dioxide decreases with increasing acclimation temperature. The oxygen concentration determines the level of active oxygen consumption in the absence of carbon dioxide and when the concentration approaches the lower lethal limit the effect of the addition of carbon dioxide is enhanced. The data found for these species for active metabolism was combined with data in the literature for resting metabolism to give estimates of the metabolism available for activity. The respiratory sensitivities of the four species were further compared by considering the estimated combinations of oxygen and carbon dioxide required to bring about asphyxiation in both flowing water and sealed containers. The ability of the blood of the fish to take up oxygen in the presence of carbon dioxide shows no direct relation to the ability of the fish to transport oxygen to the external medium under similar circumstances. (Auth. abst.)

2373. Idler, D. R., and I. Bitners. 1959. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. V. CHOLESTEROL, FAT, PROTEIN AND WATER IN THE BODY OF THE STANDARD FISH. Journal of the Fisheries Research Board of Canada, Vol. 16, No. 2, pp. 235-241.

The absolute changes in fat, protein, water and free and esterified cholesterol for the entire body of standard male and female sockeye salmon (Oncorhynchus nerka) during the Fraser River spawning migration are discussed.

The data were obtained for twelve groups of males and twelve groups of females, totalling 216 fish. The fish were caught at three locations: before entering the river, 250 miles up the river, and at one of the spawning grounds 715 miles from the first sampling station. (Auth. abst.)

2374. Warner, Kendall. 1959. MIGRATION OF LANDLOCKED SALMON IN THE FISH RIVER LAKES, MAINE. The Journal of Wildlife Management, Vol. 23, No. 1, pp. 17-27.

During the years of 1953 to 1955, 1,239 landlocked salmon were tagged on the spawning run in the Fish River Chain of Lakes in Maine to test the hypothesis that the majority of salmon spawning in outlets will return to the lake of their origin. Tags were recovered through voluntary angler reports

and recaptures on the spawning grounds. Angler reports were believed to be about 80 per cent complete. During the open-water fishing seasons of 1954, 1955, and 1956, 229 (28 per cent) of the 811 salmon tagged in 1953 and 1954 were reported caught by anglers. Total recoveries both by anglers and on the spawning run were as high as 45 per cent (1953 tagging). High percentages of the angler recoveries were obtained during the first season after tagging.

Angler recoveries during the first year following tagging showed that an average of 64 per cent of the tagged kelts moved upstream after spawning, the confidence limits being 56 to 71 per cent, while 36 per cent moved downstream. Twenty-eight salmon, migrating from known directions on the 1955 spawning run, were caught by anglers in 1956. Nine of these salmon (32 percent), tagged as kelts, did not return in the direction of their origin, but there was a net downstream migration of five salmon (18 per cent). A combined estimate, using all migrational data, showed that an average of 66 per cent of the salmon kelts moved upstream and that 34 per cent moved downstream following spawning. If the numbers of untagged migrants moving from either direction is of the same relative magnitude for various years, an average of 71 per cent originated from upstream lakes and 29 per cent from downstream lakes. This results in an estimate of 5 per cent downstream migration of salmon of upstream origin.

Over 80 per cent of the upstream angler recaptures were taken within 8 miles of the tagging point, and over 90 per cent of the downstream recaptures were caught less than 10 miles from the tagging location. The longest recorded migration was to the head of St. Froid Lake, 27 miles from the tagging point.

Eighty per cent of the tagged salmon caught by anglers were taken during April, May, and June. Over 50 per cent of the salmon were caught in the month of May alone. Virtually the entire angler catch of tagged salmon was made in four lakes, and little intermixture to other waters was apparent. The longest recorded time at large for a tagged salmon during the study was 36 months.

These migrational data provide evidence that the majority of outlet salmon spawners will return to "home" waters following spawning and emphasize the importance of fishways in dams at the outlets of salmon lakes. (Auth. summ.)

2375. Anonymous 1959. LAWS AND REGULATIONS FOR PROTECTION OF THE COMMERCIAL FISHERIES OF ALASKA, 1959. Regulatory Announcement 60, Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service.

2376. Herman, Elmer, Warren Wisby, Lawrence Wiegert, and Milton Burdick. 1959. THE YELLOW PERCH, ITS LIFE HISTORY, ECOLOGY, AND MANAGEMENT. Wisconsin Conservation Department Publication 228, 14 pgs.

This paper covers the following subjects: classification, distribution, description, habits and habitat, reproduction, growth, mortality rates and yields, ecology, angling and commercial harvest, economic value, and management.

2377. Niemuth, Wallace, Warren Churchill, and Thomas Wirth. 1959. THE WALLEYE, ITS LIFE HISTORY, ECOLOGY AND MANAGEMENT. Publication No. 227, Wisconsin Conservation Department, 14 pgs.

Topics covered in this paper are classification, distribution, description, habits and habitat, reproduction, growth, populations, mortality rates, harvest data, ecology, angling and commercial fishing, economic value and management.

2378. Larsen, Knud, and Sigurd Olsen. 1947. OCHRE SUFFOCATION OF FISH IN THE RIVER TIM AA. DRAINAGE WATER FROM LIGNITE PIT AS CAUSE OF THE CATASTROPHIES AT THE NØRRE ESP TROUT POND FARM 1941-1947. Report of the Danish Biological Station, 27 pgs.

A pond farm in West Jutland was run without mishap for about 35 years until the discharge of very acid and highly ferriferous water from a lignite pit 11 km up the buffer-deficient watercourse periodically caused a catastrophic mortality among the trout, and the pond farming had to be given up. Also the free water fishery was ruined. (Auth. summ.)

2379. Talbot, Gerald B. 1959. RESEARCH FACILITIES OF THE UNITED STATES FISHERY LABORATORY, BEAUFORT, NORTH CAROLINA. Circular 54, Bureau of Commercial Fisheries, U. S. Fish and Wildlife Service, 11 pgs.

A well illustrated report on the physical facilities of this laboratory.

2380. Phillips, Arthur M., Jr., and D. R. Brockway. 1959. DIETARY CALORIES AND THE PRODUCTION OF TROUT IN HATCHERIES. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 3-16.

Values were calculated for estimating the calorie content of trout diets. Diets calculated in terms of calories provided evidence that it is possible to reduce both the food intake and the protein content of the food without reducing either dietary efficiency or the growth of the fish. When high-calorie diets (over 700 calories per pound of food) are fed, approximately 2, 100 calories and 350 grams of protein are required to produce a pound of fish. (Auth. abst.)

2381. Eschmeyer, P. H. 1959. SURVIVAL AND RETENTION OF TAGS, AND GROWTH OF TAGGED LAKE TROUT IN A REARING POND. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 17-21.

Lots of 100 each of 2-summer-old lake trout (average total length, 8.5 inches) were marked with different types of tags in October 1955 and held in a rearing pond for 1 year. A control group of 100 fish were marked by the removal of the adipose fin.

In October 1956 the following percentages of marked fish of the various lots retained their marks: adipose fin clip, 95; No. 3 monel strap tag on the lower jaw, 91; Petersen, 86; cheek, 85; streamer (attached with No. 34 nylon gill-net twine), 1; streamer (No. 46 twine), 0; and No. 3 strap tag on the upper jaw, 0. The relative rates of survival and retention of the various types of tags in the rearing pond were dissimilar to the rates of recovery in Lake Superior of larger native lake trout marked with these same kinds of tags. The lake trout marked with Petersen, cheek, and lower-jaw tags were retarded equally (about 25 percent) in growth, but their coefficient of condition was not affected adversely by the tags. (Auth. abst.)

2382. Rucker, R. R. 1959. VIBRIO INFECTIONS AMONG MARINE AND FRESH-WATER FISH. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 22-25.

Vibrio infections among species of salmon (Oncorhynchus keta, O. gorbuscha, and O. tshawytscha) and rainbow trout (Salmo gairdneri) are characterized by bloody necrotic areas in the musculature and inflammation of the intestinal tract. Vibrio infections can be controlled in hatcheries by any of the standard sulfonamide therapeutic measures commonly used for fish. Other water- and food-borne diseases of hatchery fish are discussed. (Auth. abst.)

2383. Buss, Keen. 1959. JAR CULTURE OF TROUT EGGS. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 26-29.

The jar culture of eggs from warm-water fish has been practiced for many years. At the Benner Spring Fish Research Station, the jar method was modified and adopted for the incubation of trout eggs. One to two million trout eggs can be incubated in a space 12.5 by 2.75 feet, the space normally required by one standard hatching trough. Sixteen g. p. m. of water are required to operate this battery. Small lots of fingerling trout can also be held in these jars. This method of incubating eggs and rearing fry is also well suited for research, as the many environments are constant and the water dispersion is uniform. (Auth. abst.)

2384. Post, George. 1959. A PRELIMINARY REPORT ON THE USE OF NITROFURAN COMPOUNDS FOR FURUNCULOSIS OF TROUT, WITH SPECIAL EMPHASIS ON FUROXONE. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 30-33.

Plate inhibition tests were run using six synthetic nitrofuran compounds against Aeromonas salmonicida. One compound, trade name Furoxone N-(5-nitro-2-furfurylidene)-3-Amino-2-oxazolidone), showed good inhibition. There were no apparent toxic symptoms nor toxic effects of oral dosages of Furoxone to brook trout at levels as high as 500 mg/kg/day when given for 15 days. Furoxone dosage of 100 mg/kg of fish per day controlled furunculosis in brook trout (Salvelinus fontinalis) and cutthroat trout (Salmo clarki lewisi) in a laboratory aquarium trial. The dosage was maintained for 15 days. There was no recurrence of the disease after withdrawal of the drug. (Auth. abst.)

2385. Platts, W. S. 1959. HOMING, MOVEMENTS, AND MORTALITY OF WILD CUTTHROAT TROUT (SALMO CLARKI RICHARDSON) SPAWNED ARTIFICIALLY. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 36-38.

During the 1956 and 1957 spawning runs 4,051 cutthroat trout were marked, immediately after artificial spawning, by removing a combination of fins. Spawners were then released in the reservoir 1 to 4 miles away. It was found that trout spawned artificially would readily re-enter the tributaries, still with the desire to spawn naturally. Approximately 85 percent of the observed returns entered the home stream. The low return of spawners in the following years (2 percent) and the low percentage taken by fishermen (4 to 10) shows that natural mortality is very high (approximately 90 percent). (Auth. abst.)

2386. Jones, R. A. 1959. MODIFICATIONS ON AN ALTERNATE-POLARITY ELECTRODE. Progressive Fish Culturist, Vol. 21, No. 1, pp. 39-42.

The basic design of an alternate-polarity electrode has been modified to increase the safety, durability, and effectiveness of the apparatus. (Auth. abst.)

2387. Leitritz, Earl. 1959. MECHANICAL DRY-FEED DISPENSERS. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 43-44.

Two devices which have improved feeding technique and have saved labor in the feeding of dry feeds in California fish hatcheries are described. A dry-feed dispenser, for feeding small fish in troughs and nursery tanks, is a modified aluminum valve funnel. The pellet blower, for feeding pellets to fish in ponds, consists of two bins with a manifold system connected to a turbo-compressor. The unit is mounted on either a pickup or a flatbed truck and is operated from the truck cab. (Auth. abst.)

2388. Craddock, D. R. 1959. A MODIFIED FYKE NET FOR THE LIVE CAPTURE OF SEAWARD-MIGRATING SALMON. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 45-46.

A modified net with a live-box that relieves much of the debris problem. (Auth. abst.)

2389. Hublou, W. F. 1959. A PLEXIGLAS CONSTANT-FLOW SIPHON. Progressive Fish-Culturist, Vol. 21, No. 1, pp. 47-48.

An improved device for the administration of the prophylactic malachite green to incubating eggs for prolonged periods. (Auth. abst.)

2390. Webb, F. E. 1959. AERIAL CHEMICAL CONTROL OF FOREST INSECTS WITH REFER-

ENCE TO THE CANADIAN SITUATION. The Canadian Fish Culturist, Issue Twenty-four, pp. 3-16.

This paper was presented at a symposium on "The Effects of Chemical Control of Forest Insects on Fish Stocks" held by the Committee on Biological Investigations of the Fisheries Research Board of Canada in Ottawa, January, 1958. It presents a general discussion of the forest insect problem; the place of aerial spraying in forest insect control; and the history, policy, techniques and procedures, and evaluation of aerial spraying with particular reference to the spruce budworm.

2391. Keenleyside, Miles H. A. 1959. EFFECTS OF SPRUCE BUDWORM CONTROL ON SALMON AND OTHER FISHES IN NEW BRUNSWICK. The Canadian Fish Culturist, Issue Twenty-four, pp. 17-22.

Several species of fish in New Brunswick rivers have been adversely affected by the widespread aerial application of DDT to the forests of the province as a control agent for spruce budworm. Young salmon, brook trout and eels are reduced in number following spraying. Four species of cyprinids are relatively unaffected by the spray. Salmon populations appear to recover if spraying is not repeated over the same areas for an interval of at least three years. However, much of the budworm infested woodland has been resprayed at intervals of less than three years. Under these conditions one age-class of salmon can be affected more than once and smolt production from rivers in the area will be seriously curtailed. (Auth. summ.)

2392. Crouter, R. A., and E. H. Vernon. 1959. EFFECTS OF BLACK-HEADED BUDWORM CONTROL ON SALMON AND TROUT IN BRITISH COLUMBIA. The Canadian Fish Culturist, Issue Twenty-four, pp. 23-40.

During mid-June of 1957, an aerial spraying program was conducted on 155,000 acres of timberland on the northern portion of Vancouver Island, in an attempt to control an outbreak of black-headed budworm. The formulation used was one pound of DDT in a solvent with an emulsifier added and blended to one U. S. gallon with diesel oil. This was applied at the rate of one U. S. gallon per acre.

The damage to the fish and fish-food populations was assessed on the major streams and on four of these, were found severe. The fish mortality was confined generally to coho fry, trout, steelhead yearlings and possibly alevins of both trout and steelhead.

In the four major streams affected by spraying, the progeny of an estimated 1956 escapement of 43,000 coho adults and the juvenile stages of several thousand steelhead and trout was almost eliminated. The reduction of aquatic insects parallels the loss of coho fry and the productivity of several streams is not expected to return to adequate proportions for at least two years.

A series of bio-assays was conducted at the Nanaimo Biological Station of the Fisheries Research Board of Canada. The tests indicate that a safe concentration of the formulation used in this insect control program is below 0.05 parts per million. Analysis of water samples taken in the field showed that toxic concentrations of DDT existed at four test stations for more than three days after spraying. (Auth. summ.)

2393. Arnold, Edgar L., Jr. 1958. GULF OF MEXICO PLANKTON INVESTIGATIONS: 1951-53. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 269, 53 pgs.

Data are presented in this report on the offshore plankton collections made in the Gulf from the M/V Alaska, research vessel of the Gulf Fishery Investigations, U. S. Fish and Wildlife Service.

2394. Wolf, Ken, and C. E. Dunbar. 1959. METHODS OF INFECTING TROUT WITH KIDNEY DISEASE AND SOME EFFECTS OF TEMPERATURE ON EXPERIMENTAL INFECTIONS. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 286, 8 pgs.

Transmission of kidney disease was studied in eastern brook trout (Salvelinus fontinalis) held at 12.5°C. Fish were subjected to almost daily inoculations or exposures for 102 days, and observations were continued for an additional 200 days. Two strains of the causative bacterium were compared. The bacterium was fed alone, with glass splinters, and with bile salts. It was also inoculated by two methods of abrasion. Other fish were inoculated subdermally and held at 7°C. and 12.5°C. in order to determine the effects of these two temperatures on the kidney disease infections.

Infection was not successful by addition of the bacterium alone to the diet or with glass shards or with bile salts. Infection was accomplished by manual abrasion and autoabrasion in the presence of the bacterium. The eastern strain of the bacterium infected fish more readily than the western strain; all infections developed slowly and were chronic. (Auth. abst.)

2395. Lennon, Robert. 1959. THE ELECTRICAL RESISTIVITY METER IN FISHERY INVESTIGATIONS. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 287, 13 pgs.

A portable resistivity (or conductivity) meter is easily used in fishery investigations to obtain rapid and precise measurements of the electrical resistance (or conductance) of waters. These measurements can be used to estimate the total dissolved solids content of waters, to facilitate the selection of appropriate gear for efficient electrofishing, and to determine the velocity, stretch-out, dilution, and effective range of a solute over miles of a stream in conjunction with chemical reclammation operations. Applications of resistivity measurements on Appalachian streams are discussed. (Auth. abst.)

2396. Gumbmann, M., W. Duane Brown, and

A. L. Tappel. 1958. INTERMEDIARY METABOLISM OF FISHES AND OTHER AQUATIC ANIMALS. U. S. Fish and Wildlife Service Special Scientific Report - Fisheries No. 288, 51 pgs.

This paper is a review of current knowledge of intermediary metabolism in fish (teleosts and elasmobranchs), shellfish (mollusks and crustaceans), and certain other aquatic animals. All important research relative to the topic is mentioned, although the paper is not a totally exhaustive review. Numerous references to the original literature are included.

The review is organized around the major well-known metabolic divisions: carbohydrate metabolism, including pathways of glycolysis and the phenomenon of rigor mortis; respiratory metabolism and the tricarboxylic acid cycle; electron transport systems; phosphorus metabolism; protein metabolism; and lipid metabolism. The information is summarized in figures wherever feasible.

A section concerning the needs for research is included, and specific suggestions for needed investigations are given. (Auth. abst.)

2397. Newman, H. William. 1959. A LABORATORY FOR FISH BEHAVIOR STUDIES. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 271, 8 pgs.

A specialized laboratory has been built in Seattle, Washington, for obtaining information about fish behavior. The laboratory includes a concrete experimental tank, 60 feet long, 20 feet wide, and 5 feet deep, in which water can be recirculated at flows up to 40 cfs, and several smaller tanks for a variety of studies. Features of the laboratory include facilities for holding and acclimatizing fish, electronic control units for electrical studies, a heat-exchange system for temperature control in small tanks, means for controlling light conditions, and provisions for making chemical analyses. (Auth. abst.)

2398. Otsu, Tamio, and Richard N. Uchida. 1959. SEXUAL MATURITY AND SPAWNING OF ALBACORE IN THE PACIFIC OCEAN. Fishery Bulletin 148 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 59, pp. 287-305.

This report presents the results of gonadal development and spawning in the albacore, Germo alalunga (Bonnaterre). The study is based on examination of the reproductive organs, principally the ovaries from albacore collected in three general areas: the North Pacific, the Hawaiian Islands, and the central equatorial Pacific.

The ovaries were classified in three stages of relative maturity: early developing, late developing, and advanced, on the basis of the most advanced eggs present. According to this classification, the early developing category included the thin ribbonlike ovaries from sexually immature fish as well as ovaries from the larger, adult fish which showed no signs of egg development beyond this particular stage. The other two categories, on the other hand, included only ovaries from adult fish.

The North Pacific albacore were either juveniles or sexually dormant adults with early developing gonads. The Hawaiian albacore showed varying degrees of maturity from early developing to advanced, with the bulk of the ovaries in the late developing stage. The ovaries from central equatorial Pacific fish were in the early developing and late developing stages, with the early developing stage predominating.

Our data show that albacore taken north of Hawaii by research vessels of the Pacific Oceanic Fishery Investigations, as well as albacore taken by the Japanese in the spring live-bait and winter longline fisheries, and those in the American west coast summer fishery are nonspawning fish, either juveniles or adult fish whose gonads show no signs of incipient or past spawning. Albacore apparently do not spawn in the temperate waters of the North Pacific. On the other hand, it appears that the albacore in the region of the Hawaiian Islands and in the central equatorial Pacific represent a segment of the population which, after attaining a certain size in temperate waters of the North Pacific, move south into tropical and subtropical waters to reproduce. (Auth. abst.)

2399. Otsu, Tamio, and Richard N. Uchida. 1959. STUDY OF AGE DETERMINATION BY HARD PARTS OF ALBACORE FROM CENTRAL NORTH PACIFIC AND HAWAIIAN WATERS. Fishery Bulletin 150 from Fishery Bulletin of the Fish and Wildlife Service, Vol. 59, pp. 353-363.

Various hard parts of large (93-128 cm.) albacore, Germo alalunga (Bonnaterre), from Hawaiian waters and smaller fish (50-112 cm.) from the central North Pacific were examined for marks that could be used in determining age in this species. A cursory examination of the opercular bones and fin spines revealed no usable marks. A study of scale samples from 100 albacore showed that only one-half of them were readable, and these only with a considerable degree of subjectivity.

Several workers in other areas have reported apparent success in aging albacore by means of the rings on the vertebral centra. Their results could not be duplicated in the present study. In attempts to read the rings in the vertebrae of 212 Hawaiian and 53 central North Pacific albacore, the authors found little agreement between the counts of the different readers or even between successive counts by the same reader. Indications were seen that the rings on the vertebrae are not annuli but rather that they may be growth marks laid down randomly with time. As a clue to relative age, however, they may provide an explanation of the unbalanced sex ratio of large albacore, for they indicate the possibility that among mature fish the males grow faster than the females.

The results of this study, though largely negative, are presented for the information of those engaged at present in similar studies and for others who

may work on this problem in the future. (Auth. abst.)

2400. Ettinger, M. B., et al. 1958. A CRITICAL REVIEW OF THE LITERATURE OF 1957 ON WATER POLLUTION. Prepared for the Research Committee of the Federation of Sewage and Industrial Wastes Associations, January, 1958. U.S. Department of Health, Education, and Welfare, Public Health Service, Robert A. Taft Sanitary Engineering Center, Cincinnati, Ohio. 83 pgs.

This review is organized under the headings: biology, microbiology, chemistry, oxygen sag and stream self-purification, stream studies and surveys, stream standards, effects on water supplies, and abatement and control. The bibliography consists of 211 references. Additional references, not cited in the text, are listed following each section. (Auth. abst.)

2401. Vinogradova, Z. A. 1958. THE BIOCHEMICAL COMPOSITION OF THE BLACK SEA PLANKTON. Doklady, Akademia Nauk. SSSR. Vol. 116, No. 4, pg. 688.

Total plankton collected by a Juday No. 38 mesh net was utilized for analysis. Protein content of plankton taken in July and August of 1955 was extremely low indicating the development of phytoplankton; fat content did not exceed 2-3 percent of dry weight, while ash content reached 70 percent. In August 1956, the protein content was 4 times greater than in 1955 reaching almost 40 percent of dry weight; fat content was almost 3 times greater, and maximal ash content was 2.5 times less than in 1955.

Comparable data for plankton collected in the Sea of Azoo during July of 1955 and 1956 also shows an appreciably higher fat and protein content in 1956. Thus the 1955 food base for plankton-feeding fish was particularly unfavorable.

2402. Sorokin, Yu. I., and M. V. Kozlyaninov. 1958. DETERMINATION OF THE DEPENDENCE OF PHYTOPLANKTON PHOTOSYNTHESIS ON THE LIGHT INTENSITY IN THE WATER OF THE SEA OF JAPAN AND THE PACIFIC OCEAN. Doklady, Akademia Nauk, SSSR. Vol. 116, No. 5, pg. 863.

The effect of varying light intensity was analyzed by utilizing radioactive carbon isotope C^{14}. Uptake of the carbon isotope by phytoplankton lowered in bottles to various depths provided a measure of photosynthetic activity. Curves of underwater light intensity and curves of relative rate of photosynthesis, both plotted on depth, coincide completely. This demonstrates the exceptional degree of adaptation of marine phytoplankton to full utilization of light energy since the spectral composition at different depths is dissimilar. The curves did not coincide during bad weather (fog), possibly because the absolute quantity of light energy penetrating to the lower levels did not reach the minimum efficiently utilized by phytoplankton.

2403. Collier, Albert. 1958. GULF OF MEXICO PHYSICAL AND CHEMICAL DATA FROM ALASKA CRUISES. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries 249, 417 pgs.

This report is principally a list of chemical data collected aboard the U. S. Fish and Wildlife Service M/V Alaska while she was engaged in a biological and oceanographic survey of the Gulf of Mexico. The tables include observations on salinity, temperature, sigma-t, nitrate-nitrite nitrogen, total phosphorus, inorganic phosphorus, "carbohydrates", and "proteins". Some special data on the uranium and phosphorus content of certain water samples and sediments are included. A brief introduction includes remarks on the physical oceanography of the Gulf of Mexico and the study of organic compounds. (Auth. abst.)

2404. Guenther, Raymond W., S. W. Watson, and R. R. Rucker. 1959. ETIOLOGY OF SOCKEYE SALMON "VIRUS" DISEASE. U. S. Fish and Wildlife Service Special Scientific Report--Fisheries No. 296, 10 pgs.

Violent epizootics among hatchery reared sockeye salmon fingerlings (Oncorhynchus nerka) caused by a filterable agent have occurred. In 1954, one source of this infectious, filterable agent was found to be adult sockeye viscera used in the diet for the fingerlings. The results of observations on an epizootic in 1958 indicate that the infection may be transmitted to fingerlings from a water supply to which adult sockeye salmon have access. (Auth. abst.)

2405. Bjorklund, Richard Guy. 1958. THE BIOLOGICAL FUNCTION OF THE THYROID AND THE EFFECT OF LENGTH OF DAY ON THE GROWTH AND MATURATION OF THE GOLDFISH CARASSIUS AURATUS (LINNAEUS). Dissertation Abstracts, Vol. 19, No. 6, pg. 1423.

The primary purpose of this study is the determination of the biological function of the thyroid in the goldfish. A secondary purpose is the evaluation of the effect of day-length on the growth and maturation of the goldfish. The relationship between the length of day and the state of activity of the thyroid is also examined.

Line-bred xanthic goldfish were used throughout. Temperature, light quality and quantity, space and initial biomass were equated for all treatments within each experiment. A standard pelleted diet, fortified with beef liver, was fed at a constant proportion of the body weight in all experiments. A light-tight set of experimental chambers was constructed and all fish reared in the dark were inspected and weighed with the aid of a red lamp. An infrared photographic technique facilitated measurement of the caudal fin in regeneration experiments. Hormones and drugs were administered intra-abdominally by injection.

It was unequivocally demonstrated that no particular ration of light is necessary for normal growth and maturation of the goldfish. Immature males maintained in darkness up to 10 months matured sexually and approached spawning condition.

There was no significant difference in growth in length or weight or in the maturation of goldfish maintained in darkness, on short and on long days in fall and winter. Under controlled conditions, maturing females maintained in darkness 112 days were brought to nearly full maturity at 20°C. in January. Light appeared to have no effect on the activity of the thyroid.

Physiologically small doses of thyroxin and triiodothyronine caused thickening of the epidermis by increasing the number of cells and by enlarging and activating the bulb cells. Paling of xanthic coloration was also induced by these treatments. A correlation between the thickness of the epidermis and the height of the thyroid epithelium of untreated and control fish was also demonstrated. The effects of the thyroid on the epidermis may be adaptively significant in the closure and healing of wounds.

An increase in the efficiency of growth in both weight and length following treatment with thyroid hormones was observed. The effect was most pronounced during the 20 days following initiation of treatment.

Desiccated parrot fish thyroid gland failed to elicit morphogenic or growth responses although this material did metamorphose frog tadpoles. An antigenic effect was indicated.

An oxygen consumption experiment with thiourea gave no evidence of a calorigenic function of the thyroid. TSH failed to produce symptoms of hyperthyroidism. Severe treatments with thiourea and other substances induced symptoms of the alarm syndrome and other pharmacologic effects. Deposition of melanin occurred in animals subjected to nonspecific stress but no direct involvement of the thyroid was indicated.

Two general conclusions were drawn from this study. 1) Length of day is not an important factor in the economy of the maturing goldfish. 2) The principal function of the thyroid in goldfish is morphogenic rather than calorigenic.

2406. Dinsmore, Bruce Heasley. 1958. ECOLOGICAL STUDIES OF TWELVE STRIP MINE PONDS IN CLARION COUNTY, PENNSYLVANIA. Dissertation Abstracts, Vol. 19, No. 6, pg. 1479.

Few ecological or successional investigations have been conducted in bodies of water where mineral acidity was a dominant feature of the environment. A study was proposed by which further information could be gained concerning the organisms which live in these waters and their relation to physico-chemical characteristics present.

Twelve ponds, varying in size from nine one-hundredths of an acre to 2.57 acres, were selected for their location in different geologic horizons from which coal was removed in the Clarion-Foxburg quadrangles of Clarion County, Pennsylvania. Descriptive data of the ponds and their environs included the morphometry of the basins, physical and biological characteristics of the banks, and such other observations as would assist in better understanding the areas.

Investigations were begun in September, 1955, and continued for two years. During the period from May, 1956, to September, 1957, sampling of all ponds for chemical and biological data was conducted in three series, early summer, late summer, and spring. Additional data were obtained from 24-hour studies, gravimetric determinations, and photosynthesis-respiration experiments. As an ecological group present in all ponds at all times, plankton was selected for study in terms of kinds and numbers in relation to the environment. Samples of water for chemical determinations were taken at the same time as the plankton collections, and at the same depth. Standard methods were used for chemical and plankton analysis.

The ponds of this study, aged two to sixteen years, all began as acid ponds, but during the period of examination they varied from pH 3.6 to 7.2. Dissolved oxygen was present in favorable concentrations in all ponds and at each sampling period. Neither iron nor sulfates were present in amounts which were considered limiting.

Phytoplankton was represented by the classes Chlorophyceae, Euglenophyceae, Chrysophyceae, Bacillariophyceae, Dinophyceae, and Myxophyceae. Of the 25 species present in the ponds, 56 per cent belonged to the first two classes. Blue-green algae were represented by only one species and in alkaline water. The largest number of plankton species were present in waters having a pH of 6.8 or higher; few species were present in acid ponds. Zooplankters were generally few in species and numbers of individuals, increasing slightly with decreasing acidity. In acid ponds the largest numbers of zooplankters were chlorophyll-bearing species. Co-dominant organisms in acid ponds were Diatom spp. and a dinoflagellate, Peridinium pusillum. In two alkaline ponds Chrysococcus rufescens was an important member of the plankton population.

In a pond where fish were trapped the population appeared to be dominated by pumpkinseed sunfish (Lepomis gibbosus) from 3 to 4 inches in length.

In general, higher aquatic plants were unimportant contributors to productivity of most ponds. Their invasion of the water was dependent upon physical characteristics of the basin rather than chemical characteristics of the water.

The nature of geologic strata adjacent to the coal seam and the manner in which the overburden is handled during the recovery of coal are largely responsible for the conditions present at the beginning of a new water area and the subsequent chemical and biological succession in the water.

2407. Schmitz, William Robert. 1959. ARTIFICIALLY INDUCED CIRCULATION IN THERMALLY STRATIFIED LAKES. Dissertation Abstracts, Vol. 19, No. 7, pg. 1877.

Small, brown-stained lakes in the temperate zone present three problems that appear to be rectifiable by means of artificially induced circulation: (1) The vernal circulation is either absent or of very brief duration. Consequently a very

restricted living zone for fish exists during the summer. (2) Plant nutrients, for example, phosphorus, tend to accumulate in the hypolimnion and bottom muds during a greater part of the year. As a result they are unavailable for use in the euphotic zone. (3) The oxygen deficit under the ice is often so great as to cause winter-kill of fish.

Experiments to test the effect of artificial circulation in such lakes (0.31 to 6.1 ha) were conducted in an attempt to solve problems two and three. Tests were conducted under both summer and winter conditions.

In the first tests, under summer conditions, water pumps were used to pump hypolimnetic water into the epilmnion. In later tests the turbulent effects of bubbles of compressed air were used to bring up the hypolimnetic water. This was accomplished by delivering compressed air through a perforated plastic pipe suspended in the hypolimnion across the length of the lake. Daily treatments varied from 5.6 to 101 liters of air (1 atm, 20° C.)/m^3 of lake volume.

The "air-lift" technique was more than ten times as efficient as the water pumping method.

With both methods, however, it was possible to bring phosphorus (as indicated by the movement of radiophosphorus previously placed in the hypolimnion) into the euphotic zone. Homoiothermal conditions were inducted above the level of the air-pipe or above the water-intake (depending on the method of treatment). At lower rates of air treatment, i.e., 5/6 l/m^3/day, P^{32} was transported through the thermocline without disrupting that layer. Additions of oxygen with the "air-lift" technique required a minimum of 2.4 hp-hrs for each kg of oxygen added. In order to evaluate the effects of air-turbulence on lakes of different sizes, the theoretical amount of work required to compress the air, to the necessary hydrostatic pressure, (and also to expand the bubble) was compared with the change in the volume of the epilimnion. The values obtained were 8.17×10^2 gm-cm for the work applied to each m^3 of lake volume for each m^3 of increase on the volume of the epilimnion.

Serious temporary depletions of oxygen occurred at higher rates of circulation, owing to the dilution effect and possibly to accelerated oxygen-demands.

In the first tests under winter conditions, water pumps were used to pump water onto the snow from beneath the ice. It was sought to increase the amount of light transmitted through the ice in this way. In later tests, the turbulent effects of compressed air were used, this time to bring the warm water into contact with the ice surface. In the latter method the physical installation was essentially the same as that used in the summer tests. Daily additions of 1.9-3.4 liters of air (20°C., 1 atm)/m^3 of lake volume were applied in two tests on a lake of 6.1 ha.

The concentration of oxygen increased during the tests in which water was pumped, however, indirect evidence suggests that the increase was due to the return of pumped, aerated water from the ice-surface, rather than as a result of increased photosynthesis. In any event, this method was again ineffective when compared with the "air-lift" technique.

The daily application of 3.4 and 1.9 liters of air served to maintain the concentrations of oxygen at about 7 ppm and 2 ppm, respectively. Average water temperatures were reduced to as low as 0.7°C. in one test. It was suggested that preventive treatment was more effective than remedial treatment.

The implications for the use of the "air-lift" method as a usable instrument for the experimental manipulation of lakes, and as an aid to lake management, are discussed.

2408. Beskrovnyy, A. M., and O. A. Sukacheva. 1959. A HISTOLOGICAL ANALYSIS OF THE GONADS OF LAKE CHUDSKOYE WHITEFISH ACCLIMATIZED IN KHAR'KOV OBLAST BASINS. (GISTOLOGICHESKIY ANALIZ GONAD CHUDSKOGO SIGA, AKKLIMATIZIRUYEMOGO V VODOYEMAKH KHAR'KOVSKOY OBLASTI). Dopovidi Akademii nauk Ukrains'koi RSR, No. 1, pp. 88-92.

Observations on the whitefish from the Lake Chudskoye (Peipus) in waters of the Khar'kov oblast have shown a normal development of reproductive glands of the fish in its new climate, which refutes the apprehensions of some Kiyev histologists, that the whitefish might, under influence of a milder climate, develop a tendency to become hermaphrodite. There are four microphotographs, and two Soviet references. (SOV/STEP 21-59-1-23/26)

2409. Zhuravel', P. A. 1959. A MYSIS THAT IS NEW FOR THE DNEPR SYSTEM - HEMIMYSIS ANOMALA SARS - IN THE DNEPR RESERVOIR. (NOVAYA DLYA SISTEMY DNEPRA MIZIDA - HEMIMYSIS ANOMALA SARS V DNEPROVSKOM VODOKHRANILISHCHE.) Dopovidi Akadamii Nauk Ukrains'koi RSR, No. 1, pp. 85-87.

A Hemimysis anomala Sars was revealed in the lower, near the dam portion of the Dnepr reservoir (Lenin Lake) in September 1958 at depths of 5-30 m and more. It was brought into the reservoir in 1957, together with the estuary fauna caught in the upper portion of the Dnepr estuary, and the lower (estuary-like) Ingulets River, to stock the new reservoir. The mysis now behaves like a deep-water species. The dragging of the bottom was performed by the author, and a group of workers of the Dnepropetrovsk Institute of Hydrobiology, which included V. L. Bulakh, P. Ya. Lavrinenko. The Hemimysis anomala was transplanted to breed in the Dnepr estuary and Dnepr reservoir areas, to provide forage for the fish. (SOV/STEP 21-59-1-22/26

2410. Monchenko, V. I. 1959. ON THE SYNONYMICS OF ATTHEYELLA (BR.) NORTHUMBRICA (BRADY) (COPEPODA). (K SINONIMIKE ATTHEYELLA (BR.) NORTHUMBRICA

(BRADY) (COPEPODA).) Dopovidi Akademii nauk Ukrains'koi RSR, No. 1, pp. 93-97.

On the basis of materials collected in the Ukraine, the subspecies Attheyella northumbrica trisetosa Chappius and Attheyella northumbrica coronata are identified with the typical form which, in the author's opinion, should be named Attheyella dentata. The author describes the physical characteristics of this species of crustacea and notes that the Ukrainian crustaceas as a whole have been insufficiently studied. There are three sets of diagrams and 11 references, of which seven are Soviet, three German and one English. (SOV/STEP 21-59-1-24/26)

2411. Puchkov, V. G. 1959, LARVAE OF THE SUBFAMILY HETEROGASTRINAE (HETEROPTERA, LUGAEIDAE) OF THE UKRAINIAN FAUNA (LICHINKI PODSEMEYSTVA HETEROGASTRINAE (HETEROPTERA LUGAEIDAE) FAUNY UKRAINSKOY SSR). Dopovidi Akademii nauk Ukrains'koi RSR, No. 1, pp. 98-100.

The article gives the general morphological characteristics of the larvae of Heterogastrinae in the Ukraine. Eight different species are described. There are 1 set of diagrams and two references, one of which is English and one unidentified. (SOV/STEP 21-59-1-25/26)

2412. Zotin, A. I. 1958. THE MEMBRANE HARDENING ENZYME OF SALMON EGGS (FERMENT ZATVERDEVANIYA OBOLOCHEK U YAITS LOSOSEVYKH RYB). Doklady Akademii nauk SSSR, Vol. 121, No. 6, pp. 1105-1108.

In connection with the investigation of eggs of various fishes and sea urchins, it was found that the egg secretes after fertilization or after activation certain substances which bring about the hardening and solidification of the egg membranes. In the perivitelline liquid of the just fertilized eggs of salmon a substance is contained which leads to a hardening of the membrane in the case of not activated eggs. The tests were carried out with embryos of sea salmon (Salmo salar m. sebago Girard) and trout (S. trutta m. lacustris L.) in the years 1956 and 1957 in the Svirskiy rybovodnyy zavod (Svirskiy Fish Breeding Institute). As it is known, water, salts, and highly dispersed colloids may permeate the membranes of salmon but not low dispersed colloids. Thus the mentioned substance is an unstable compound of high molecular weight. It is rapidly inactivated by high temperatures. Therefore it could be believed to be an enzyme. Even when it is still in the cytoplasm of the egg it may be inactivated. From the surface layer of the egg of osseans particular substances are excreted which take part in the formation of the perivitelline space. In the cortical layer of the cytoplasm of unfertilized eggs these substances are represented by vacuoles which disappear after fertilization or activation. In order to find out whether the hardening enzyme is contained in the cortical alveoli or not the author carried out a series of investigations with different NcCl concentrations. In the tests, it was proved that the hardening enzyme is lacking in the case of salmon among the substances which take part in the formation of the perivitelline space and probably also in the vacuoles of the inactivated eggs. However, it may be seen that the hardening of the membranes in the embryos of salmon cannot take place without the participation of the hardening enzyme in this process. There are three figures, two tables, and 21 references, six of which are Soviet. (SOV/STEP 20-121-6-44/45)

2413. Pravdin, I. F. 1956. FISH PRESERVES, FISH AND FISH SUPPLY IN WESTERN KARELIAN LAKES (RYBNYYE UGOD'YA, RYBY I RYBNYYE ZAPASY VODOYEMOV ZAPADNOY KARELII). Trudy Karelo-Finskogo filiala Akademii nauk SSSR (Petrozavodsk); Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 135.

Reservoirs in the western part of Karelia have been divided into groups: Suoyarvi, Gimoly, Reboly, and Severnaya (with two subgroups, Kem and Kovda). Most lakes in this part of Karelia are poor in fish food. Water plants are weak, and most of them are concentrated in the Suoyarvinskaya group. Rovkul'skoye, Leksozero, Suayarvi, and Salonyarvi Lakes are rich in zooplankton. The author discusses fish types from the basins of Onega and Ladoga Lakes, the White Sea, and the Shuya, Suna, Vyg, Kem', Keret', and Kovda Rivers. It was established that 35 species of fish inhabit the lakes. Varieties of salmon, grayling, smelt and carp predominate. Salmon form the base of the fishing industry in the lakes, but their commercial yield is very modest. Their supply is decreasing, principally because the Karelian rivers, which flow into the White Sea, and which are the sole route to the spawning grounds, are being closed by hydroelectric establishments.

2414. Proshkina-Lavrenko, A. I. 1956. NEW CHAETOCEROS GENERA FROM THE BLACK AND AZOV SEAS (NOVYYE PREDSTAVITELI RODA CHAETOCEROS IZ CHERNOGO I AZOVSKOGO MOREY). Botanicheskie materialy otdela sporovykh rastenii Botanicheskogo instituta imeni V. M. Komarova (moskva), Vol. 11, pp. 51-56; Referativnyy zhurnal, Geografiya, 1957. No. 6, p. 142.

The author describes the new species, their distribution and their forms in the phyloplankton of the Black and Azov Seas, found between 1950 and 1954. Chaetoceros scabrosus sp. nova was observed in Novorossiysk Bay during September 1953, although it had not been there from 1950 to 1952. C. Lorenzianus var. solitarius var. nova is rarely found in the northwestern Black Sea, and only as isolated specimens occurring in autumn in the Novorossiysk and Sevastopol'Bays. C. Lorenzianus f. subsalinus f. nova is often found at the mouth of the Don River, and covers the Akhtari and Taganrog Bays. From June to October C. similis f. solitarius nova is widely distributed over the northwestern Black Sea region; single plants are found in the Sevastopol' and Novorossiysk Bays from August to

October and, less frequently, from February to May. The article includes sketches.

2415. Saidov, Yu. S. 1956. FISH HELMINTH IN CERTAIN SMALL LAKES OF DAGESTAN (GEL'MINTOFAUNA RYB NEKOTORYKH MALYKH VODOYEMOV DAGESTANA). Trudy Instituta zhivotnovodstva Dagestanskogo filiala Akademii nauk SSSR (Makhach-Kala), Vol. 3, pp. 84-85; Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 137.

Two kinds of fish, carp and mullet, are found in the reservoir of Buynaksk. When they were studied for helminth, it was discovered that mullet were not infested at all, while two of the 22 dissected carp were found to be infested (one with Ligula intestinalis and one with Diplostomum spathaceum larvae). Only one breed of fish inhabits Eyzeman Osero (Lake). This is a local lake trout variety. Out of 30 dissected fish, 15 were infested with Proteocephalus neglectus. Similarity and paucity of invertebrates capable of acting as intermediate carriers, identical fish types, small number of piscophagous birds, and certain physical and chemical properties of the water explain why these small isolated lakes contain so few parasites.

2416. Kadak, A. Yu., and L. A. Rannak. 1956. DEVELOPMENT OF AN ACTIVE FISHING INDUSTRY IN THE OPEN WATER OF THE NORTHEASTERN BALTIC SEA (O RAZVITII AKTIVNOGO RYBOLOVSTVA V OTKRYTYKH VODAKH SEVEROVOSTOCHNOY CHASTI BALTIYSKOGO MORYA). Investiia Akademii nauk Estonskoi SSR, seriia obshchestvennykh nauk (Tallinn), Vol. 5, No. 3, pp. 232-234; Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 165.

Total amount of fish caught in Estonia in 1955 exceeded by 215 times the catch of 1939. In 1955 active fishing methods accounted for 61 thousand centners of fish (12 percent of the total catch); the remainder was caught by passive techniques at spawning time. The authors discuss the necessity of expanding active fishing techniques in the open sea.

2417. Sklyarova, T. V., Shcherbakova, Z. P. 1956. ORIGIN AND DEVELOPMENT OF PLANKTON AND BENTHOS ON COLLECTIVE FARMS IN VORONEZHSKAYA OBLAST (K VOPROSU O SOSTAVE I RAZVITII PLANKTONA I BENTOSA KOLKHOZNYKH PRUDOV VORONEZHSKOY OBLASTI). Trudy Voronezhskogo zoovetinstituta (Voronezh), Vol. 12, pp. 67-78; Referativnyy zhurnal, Geografiya, 1957, No. 6, pp. 136-137.

The authors describe seven ponds in the Verkhne-Khava district which were formed when depressions with moderately sloping grassy banks were flooded. Water surface was clear and free of weeds; the ground was chernozem ooze with deposits of clay and plant residuum. Ponds, formed where natural or artificial bodies of water had previously existed, were stocked with pike, crucian carp, marlin, red perch, roach and perch. In 1950 some ponds were stocked with spawn and yearling carp. Since all these ponds were located in inhabited areas, they were also used for irrigation, for the cattle drinking water and for other agricultural and domestic purposes. When the ponds were examined in June, August and October, 1951, it was established that 112 invertebrate species were present in them. These supplied food for the fish. Zooplankton and benthos were classified by species and by seasonal genetic components. The ponds were found to contain 54 zooplankton species. Copepoda of the Cyclopidae group were most common; they were found, together with rotifera and cladocera, in all ponds. Benthos contained organisms of the following groups: Oligochaeta (3 species), Hirudinea (3), Malacostraca (2), Chironomidae larvae (13), other Insecta larvae (26), Mollusca (11). The larvae of the following were most frequently found: Chironomus plumosus and Culicoides, Ansellus aquaticus, Herpobdella nigricollis and Glossiphonia complanata. Four of the seven ponds studied had "flowering water", caused by the blue green water flower Aphanizomenon flos aquae. The number of indwelling species and the amount of available benthos and plankton differed from pond to pond. The authors advise that these data should be considered when the ponds are stocked.

2418. Malevitskaya, M. A., and A. M. Lopukhina. 1955. DATA FOR THE STUDY OF PARASITES OF FISH IN THE LOWER DNEPR (MATERIALY K IZUCHENIYU PARAZITOV RYB NIZHNEGO DNEPRA). Trudy nauchno-issledovatel'skogo Instituta produvogo 1 ozerno-rechnogo rybnogo khoziaistva (Kiev), No. 10, pp. 40-49; Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 137.

Parasites of 11 classes were counted during a study of fish in the lower Dnepr. The most common types were digenetic trematodae (37 species). Multigenetic trematodae (30 species) were less common. Of a special interest were Philometra sanguinea found on the tail fins of crucian carp (54.5 percent), and Philometra obturans found in the blood stream of pike. Samples collected during this study showed that the trematodae group was more numerous than any other fish parasite group; this is explained by the abundance of aquatic invertebrates which act as intermediate hosts, and of piscophagous birds. Certain fish parasite larvae can be dangerous to man, to the carnivorous and to the omnivorous animals. These larvae are Metagonimus yokagawai of the Neterophydae group, and also various species of the Opisthorcidae group. Fish which have been infested with parasite larvae may infect birds, commercial mammals and even man. Parasitological studies have shown that the scavenger fish of the Konskaya and Bazavluk backwaters on the Lower Dnepr were badly infested with the types of parasites which can also infest commercial types. This situation creates conditions dangerous for the latter.

2419. Dubrovskiy, N. V. 1956. ZOOBENTHOS IN FISH PONDS ON THE COLLECTIVE FARM IMENI STALIN IN THE BOGODUKHOV RAYON (ZOOBENTOS RYBOVODNYKH PRUDOV KOLKHOZA

IM STALINA BOGODUKHOVSKOGO RAYONA). Uchenye zapiski Kharkovskogo universiteta (Kishinev), Vol. 23, No. 2, pp. 3-9; Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 142.

The author presents a list of bottom-dwelling species in three ponds. The main, according to numbers and bulk, are the oligochaeta and the chironomid larvae. The biomass of zoobenthos is considerably greater in April and May than it is in summer months. This can be explained by the fact that carp, feeding on zoobenthos, destroy much of it.

2420. Chepurnov, V. S., M. S. Burnashev, and V. N. Dolgiy. 1956. DATA ON THE COMPOSITION AND DISTRIBUTION OF SUMMER ZOOPLANKTON IN THE BURNAS AND ALIBEY ESTUARIES (SVEDENIYA O SOSTAVE I RASPREDELENII LETNEGO ZOOPLANKTONA V LIMANAKH BURNAS I ALIBEY). Uchenye zapiski Kishinevskogo universiteta (Kishinev), Vol. 23, No. 2, pp. 3-9; Referativnyy zhurnal, Geografiya, 1957, No. 6, p. 142.

The Burnas and Alibey estuaries are a part of the Tuzly estuary group (estuaries in the northwestern Black Sea region). Their zooplankton assumes marine forms. The main Copepoda are: Harpacticoida, Acartia, Centropages. The larvae of Nauplii Copepoda, Nauplii and Cypris Cirripedia are very prominent. The following molluscs Gastropoda and Lamellibranchiata are common molluscs; the dominant Malacostrace are Idothea and Gammaridae. The author gives a qualitative and quantitative description of the zooplankton of both estuaries in summer, 1954.

2421. Matyukova, T. G. 1955. PRELIMINARY STUDY OF AQUATIC AND SHORE VEGETATION IN THE TYUP GULF OF LAKE ISSYK-KUL' (PREDVARITEL'NYYE ITOGI IZUCHENIYA VODNO-PRIBREZHNOY RASTITEL'NOSTI TYUPSKOGO ZALIVA OZERA ISSYK-KUL'.) Uchenye zapiski biologo-pochvennogo fakulteta Kirgizskogo universiteta (Frunze), No. 5, pp. 50-69. Referativnyy zhurnal, Geografiya, 1957, No. 6, pp. 134-135.

Aquatic and shore vegetation was studied to discover how much vegetable food plants could supply to increase the number of fish and to develop the hunting industry. Vegetation is nonuniformly distributed around the gulf and depends upon ecological factors. Richest growth is found in little backwaters along the bank; the remainder of the bank is poor both in vegetation type and amount. The most important submerged phanerogamous plant is the pectine weed; the most important surface plant, the bullrush. Spore plant groups are much more important in the area in question. Among these, aquatic characeae are very valuable for feeding commercial fish in Lake Issyk-Kul'. The author describes most characteristic associations in great detail. She gives information on growth rate of leading plants (bullrush, reed, tuberous reed, pond weed, yarrow, ruppia-weed, and chard). Plant growth rate was calculated for each 1 sq. m. of area in Gusut, when every plant was flowering and seeds were maturing. Preliminary data indicate that the gulf's growing area is about 17.35 sq. m., or 16.7 percent of its tidal area. Plants supply approximately 40 tons of raw matter per hectare, or 69,400 tons over the entire area.

2422. Prakash, A., and D. J. Milne. 1958. FOOD AS A FACTOR AFFECTING THE GROWTH OF COHO SALMON OFF THE EAST AND WEST COAST OF VANCOUVER ISLAND, B. C. Progress Reports of the Pacific Coast Stations, Fisheries Research Board of Canada, No. 112, pp. 7-9.

Coho salmon caught off the east coast are smaller compared to those caught off the west coast. Tagging and fin clipping studies have discounted the possibility that this differential growth reflects two distinct spawning stocks.

Stomach analysis shows that crustacea formed an important food item of east coast salmon throughout the summer, while fish was the dominant item of west coast salmon. Oceanographic differences between these areas likely are related to the different feeding conditions. It is necessary to assume that most of the east coast salmon spend their entire ocean life in inside waters.

2423. Lynch, R. G. 1958. MUNICIPAL, INDUSTRIAL AND IRRIGATIONAL USE OF AVAILABLE WATER SUPPLIES. Industrial Wastes, No. 3, pp. 65-66. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 7. 1959.

Figures are given to show the great demand on water supplies in Wisconsin, especially for irrigation; and the maintenance of stream flow by restricting the use of water is discussed in relation to the pending legislation and using the Embarrass river as an example. Comparisons are made with the laws imposed in other states. It is considered that no permanent water rights, as proposed in the pending legislation, should be established in Wisconsin until the flow of small streams handy for farm irrigation pumps has been examined.

2424. Cervenka, R., and M. Korbova. 1957. SYNCHRONIZED DETERMINATION OF pH, ALKALINITY, CALCIUM AND MAGNESIUM. Coll. Sci. Rep., 1952-1955, Inst. Hyg. Prague, No. 6. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 86. 1959.

A method has been developed by which the pH value, the alkalinity, and the concentration of calcium and magnesium in water can be determined in the same sample within a few minutes. The pH value is determined electrometrically using glass electrodes, and the alkalinity is determined by titration with 0.1N hydrochloric acid to pH 4.6. After this titration the pH value is adjusted to 12.4 and calcium is determined by titration with Complexone using Murexide as indicator. The solution is then acidified, the pH value is adjusted to 10.0 with ammonia, and magnesium is determined by

titration with Complexone III using Eriochrome black T as indicator.

2425. Mitjagina, O. V., and V. D. Terentjeva. 1955. DETERMINATION OF HARDNESS IN WATER USING TRILON B. Hyg. & Sanit., Moscow, No. 1, pp. 42-45. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 87. 1959.

The authors describe the method of determining hardness in water using Trilon B.

2426. Cervenka, R. 1957. ELECTROCHEMICAL DETERMINATION OF OXYGEN IN WATERS. Coll. Sci. Rept., 1952-1955, Inst. Hyg. Prague, No. 7. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 94. 1959.

The method described for the determination of dissolved oxygen in water is based on its depolarization effect, and involves the use of a cell in which the cathode is a dropping mercury electrode and the anode is zinc in a 1M solution of zinc sulphate. The current density in this cell is directly proportional to the concentration of dissolved oxygen.

2427. Chancellor, A. P. 1958. THE CONTROL OF AQUATIC WEEDS AND ALGAE. Ministry of Agriculture, Fisheries and Food, H. M. Stationery Office, London, 20 pgs. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 186. 1959.

This report is based on Fisheries Notice No. 28, published by the Ministry of Agriculture and Fisheries. For purposes of control, aquatic plants are classified into three groups, emergent species, submerged species and algae. A general survey is given of methods of biological, mechanical, and chemical control in relation to the type of weed. The use and toxicity to fish, livestock, and man, of the following chemicals are discussed; sodium arsenite, Monuron, 2, 4-D, MCPA, trichloraecetic acid, sodium chlorate, and Dalapon. Sodium arsenite is the most effective and economical chemical for the control of submerged species in static water; the other compounds, particularly Dalapon, are all useful for control of emergent species in static or running water but there is no entirely satisfactory method for the control of submerged species in running water. The control of algae is discussed separately, including reservoir management and chemical control, with particular reference to the use and toxicity of copper sulphate, a lime wash containing 10 per cent copper sulphate, chlorine and allied compounds, sodium arsenite, rosin amine compounds containing abiethylamine acetates, and 2, 3-dichloronaphthoquinone. A selected bibliography is appended.

2428. Moore, E. W. 1958. THERMAL "POLLUTION" OF STREAMS. Industr. Engng Chem. 50, No. 4, 87A-88A. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 189. 1959.

The author discusses the effects on streams of the discharge of heated waste waters. With increase in temperature, the density and viscosity of the water are lowered, the solubility of oxygen is reduced, and the rate at which oxygen is absorbed from the air is increased. The need for further studies on the effect of thermal loading on the oxygen balance of streams is emphasized. Methods for controlling the discharge of heated waste waters are indicated.

2429. Tsivoglou, E. C., A. F. Bartsch, D. E. Rushing, and D. A. Holaday. 1958. EFFECTS OF URANIUM ORE REFINERY WASTES ON RECEIVING WATERS. Sewage Industr. Wastes, 30, pp. 1012-1027. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 191. 1959.

In 1955 and 1956, surveys were made of the condition of streams receiving waste waters from uranium refining operations in the Colorado Plateau area. It was found that the gross radioactivity and concentration of soluble radium in the effluents from a number of the mills and in samples of water from some of the receiving streams exceeded the usually accepted maximum permissible amounts. All but one of the mills in operation at the time of the surveys discharged most of their wastes to tailings ponds and at these sites the streams received only small volumes of effluent directly, in addition to seepage from the tailings pond. At the other mill, the tailings pond was not in use and all waste waters, including sands and slimes, were discharged to the receiving stream. It was found that stream biota and samples of silt were good indicators of recent radioactive pollution, the biota reflecting mainly the concentration of soluble radioactivity in the water while the silt indicates the radioactivity in suspension. In view of the long half-life of radium, the ultimate fate of radium in streams is important, and further studies are required on this subject.

2430. Klotter, H. E. 1957. FOAMING CAUSED BY DETERGENTS IN A CANALIZED RIVER, ITS ORIGIN AND IMPORTANCE. Vom Wasser, No. 24, pp. 171-202. Water Pollution Abstracts, Vol. 32, No. 1, Abst. No. 192. 1959.

An illustrated description is given of excessive foaming in the river Neckar, especially in locks and below weirs. The foaming was caused by surface-active washing and cleaning agents discharged into the river with waste waters. Determinations are described of the content of detergents in the river, of the oxygen-content and the effect on it of intensive aeration during filling of the locks, and of the effect of detergents on the permanganate demand and the B. O. D. Foaming is independent of the concentration of detergent and of the period of aeration. The greater the amount of fine air bubbles present as collecting surfaces, the greater is the probability that even small amounts of detergent in water will cause foaming. The stability of the foam is dependent on its height; at the water-foam surface the foam is redissolved in the water, forming a detergent-containing film which does not prevent but does delay gas exchange with the atmosphere. Movement of ships may have an important effect in destroying

this film and bringing the surface-active substances into contact again with other surfaces such as dirt particles. The presence of the commonly used anionic washing agents can prevent the biochemical decomposition of polluting matter. B.O.D. determination in waste waters containing detergents may be too low by about 20 per cent. Methods of removal of detergents are discussed; a flotation process with suitable aeration is recommended.

2431. Warren, P. J. 1958. DESCRIPTION OF AN IMPROVED ROTATING COUNTER FOR ZOOPLANKTON. J. Cons. int. Explor. Mer., No. 23, pp. 337-339. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 239. 1959.

An illustrated description is given of a rotating counting stage for zooplankton, developed from a model described by Ward, J. to enable more rapid examination and counts to be made of the larger larval forms.

2432. Hood, D. W., B. Stevenson, and L. M. Jeffrey. 1958. DEEP SEA DISPOSAL OF INDUSTRIAL WASTES. Industr. Engng Chem., No. 50, pp. 885-888. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 332. 1959.

The deep sea disposal of highly toxic waste waters, containing mainly chlorinated hydrocarbons from the Deer Park, Tex., plant of the Shell Chemical Corporation was investigated. The method of disposal of the wastes, which are pumped slowly from a barge travelling at maximum speed for a distance of 30 miles in an area where the depth varies from 200 to 800 fathoms, was studied, to determine the effect on aquatic life. The organic chloride present in the sea water after disposal, was determined by extraction of 1-gal samples with toluene and reaction with metallic sodium in liquid ammonia, followed by potentiometric titrations of the chloride. Muds were analyzed by the same method. It was found that marine bacteria were relatively insensitive to the wastes, but phytoplankton and zooplankton were affected by them. Mainly phytoplankton cultures were used, and the effect of the waste waters on photosynthesis was determined by light and dark bottle techniques. Studies on diffusion in sea water resulted in a limited amount of data, and from all the results obtained, it was concluded that disposal of these waste waters could be carried out satisfactorily by the method described, provided dumping took place beyond the 400 fathom line, to avoid possible damage to fishing grounds. It is recommended, however, that extensive investigations should be made before deep sea disposal of any trade waste water is carried out. Diagrams showing the position of the sampling stations, and graphs of results obtained are included.

2433. Neil, J. H. 1957. PROBLEMS AND CONTROL OF UNNATURAL FERTILIZATION OF LAKE WATERS. Proc. 12th Industr. Waste Conf., Purdue Univ. Engng Extn Ser. No. 94, pp. 301-316. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 365, 1959.

After discussing briefly the factors affecting the productivity of lakes under natural conditions, the author discusses the effects of unnatural enrichment. Factors leading to increased enrichment include the clearing of forests and farming of land which accelerate erosion, the use of chemical fertilizers, and the increased trend of urbanization. Unpleasant blooms of blue-green algae occurred in Sturgeon Lake, one of a series of relatively shallow unstratified lakes in southern Ontario. Investigations were carried out over a period of years on factors affecting productivity and it was found that phosphorus appeared to be an important factor, although other factors, such as climatic conditions and the presence of other chemical constituents, also affected the rate of algal growth. The greatest single source of phosphorus was found to be the primary sewage-treatment plant at the town of Lindsay, the effluent from which is discharged to a river flowing into the lake. Experiments showed that phosphate could be removed by chemical coagulation of the crude sewage with alum and activated silica, and it is suggested that this method of control could be applied if algal blooms should in future occur consistently in the lake. As the volume of water flowing through the lake is relatively large, although nutrients may accumulate slowly under present conditions the level of nutrients would be lower if such control were applied. However, this would not be the case in lakes with low flow, where accumulated nutrients would tend to be circulated continuously.

2434. Dappert, A. F. 1958. THE USE OF STREAM DATA IN ADMINISTRATION OF POLLUTION ABATEMENT PROGRAMMES. Robert A. Taft Sanitary Engineering Center, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

Examples are given of the use of stream data by the New York State Water Pollution Control Board for the classification of surface waters, for determining the degree of treatment to be given to sewage or waste waters to maintain satisfactory conditions in the receiving stream, and for solving special problems of sewage and waste disposal.

2435. Tarzwell, C. M. 1958. DISSOLVED OXYGEN REQUIREMENTS FOR FISHES. Robert A. Taft Sanitary Engineering Centre, Tech. Rept. W-58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

The author indicates the factors which must be taken into account when establishing dissolved oxygen criteria for fish and fish-food organisms, and reviews the work of various investigators on the effect of some of these factors. The need for supplementing laboratory experiments with field studies is stressed. A bibliography of 27 references is appended.

2436. Streeter, H. W. 1958. THE OXYGEN SAG

AND DISSOLVED OXYGEN RELATIONSHIPS IN STREAMS. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

The oxygen sag curve in polluted streams is defined and its mathematical expression is presented. The effect of various contaminants on the re-aeration of polluted streams is outlined briefly and the use of simplified methods for calculating oxygen relations in streams is indicated. In discussion, LeBosquet, M., described a simplified method of dissolved oxygen computation, and discussed briefly experiences in the use of the oxygen sag formula for calculating the degree of treatment required by polluting discharges, for determining the effect of increased flow and of canalization, and for estimating future conditions in rivers.

2437. O'Connor, D. J. 1958. THE MEASUREMENT AND CALCULATION OF STREAM RE-AERATION RATIO. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

A theory of re-aeration in streams is presented; its applicability for determining the re-aeration coefficient has been verified by field studies.

2438. Velz, C. J. 1958. SIGNIFICANCE OF ORGANIC SLUDGE DEPOSITS. Robert A. Taft Sanitary Engineering Centre. Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

The author discusses the effect of sludge deposits on the appearance of streams and describes methods for determining areas of potential sludge deposition in streams and for the quantitative evaluation of the amount of sludge which may be deposited. The quantitative estimation of the effect of deposits on the concentration of dissolved oxygen is then considered. The author stresses the fact that the oxygen balance is affected not only by the presence of deposits but also by the period of time during which deposits can accumulate without being disturbed. Some examples of the effect of sludge deposits on the oxygen balance of specific rivers are given.

2439. Gameson, A. L. H., and M. J. Barrett. 1958. OXIDATION, RE-AERATION, AND MIXING IN THE THAMES ESTUARY. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

The authors describe methods used by the Water Pollution Research Laboratory in studying self-purification in rivers and estuaries, and discuss in some detail experiments on factors affecting the rate of re-aeration of polluted water and the results of the survey of conditions in the Thames estuary, carried out by the Laboratory. A bibliography of 57 references is appended.

2440. Thomas, H. A. 1958. MIXING AND DIFFUSION OF WASTES IN STREAMS. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Abst. No. 367. 1959.

Factors causing longitudinal mixing of waste waters discharged to streams, the effects of such mixing, methods of determining and expressing the results of studies on longitudinal mixing, and theoretical formulae are listed briefly. Some results of tracer tests on mixing in specific rivers are shown in tables, and a bibliography of 15 references is appended.

2441. Churchill, M. A. 1958. EFFECTS OF IMPOUNDMENTS ON OXYGEN RESOURCES. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

From observations on reservoirs of the Tennessee Valley Authority, the author discusses the effect of impounding reservoirs on the oxygen balance in streams. Different effects are obtained with deep multi-purpose storage reservoirs with deeply-submerged power intakes, and with shallower single-purpose reservoirs with intakes near the water surface. The importance of temperature is discussed in detail. The results of observations on several reservoirs of the T. V. A. are shown in graphs. In discussion, Hull, C. H. considered possible methods for increasing the concentration of dissolved oxygen in water released from impounding reservoirs.

2442. Haney, P. D., and J. Schmidt. 1958. REPRESENTATIVE SAMPLING AND ANALYTICAL METHODS IN STREAM STUDIES. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

2443. Schroepfer, G. J. 1958. APPLICATION OF STREAM DATA TO WASTE TREATMENT PLANT DESIGN. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth. Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

An equation for estimating the oxygen balance in a polluted stream has been developed during studies by the Minneapolis-St. Paul Sanitary District to determine the degree of treatment which will be required for wastes discharged to the Mississippi River in the years 1980 and 2000. Factors affecting the determination of the various units used in the equation are discussed.

2444. Wisniewski, T. F. 1958. ALGAE AND THEIR EFFECTS ON DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND. Robert A. Taft Sanitary Engineering Centre, Tech. Rep. W58-2, U. S. Publ. Hlth Serv., 206 pp. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 367. 1959.

During a survey of the Fox River, Wis., studies

were made to determine the numbers and types of algae in the river and their effect on the oxygen balance. It was found that the rate of oxygen consumption by respiration of live algae was much lower than that required for biological oxidation of dead cells, and that the ultimate B. O. D. of live algae was almost the same as that of dead algae. Under the experimental conditions, the rate of photosynthetic oxygen production during continuous exposure to light exceeded the B. O. D., resulting in a significant net gain in the concentration of dissolved oxygen. The production of dissolved oxygen which appeared to be related to the concentration of suspended solids, increased downstream, as the predominant type of algae changed from the blue-green species, characteristic of the still waters of Lake Winnebago, to green algae and diatoms. The results of the experiments are given in tables and graphs. In discussion, Bartsch, A. F., described briefly the results of laboratory experiments on the effect of live algae or decomposed algal cells on the determination of B. O. D.; the effect of increasing numbers of algae on the B. O. D. determination; and the difference in rates of oxygen consumption between samples, containing algae, incubated in the light and in the dark.

2445. Cairns, J., and A. Scheier. 1957. THE EFFECTS OF PERIODIC LOW OXYGEN UPON THE TOXICITY OF VARIOUS CHEMICALS TO AQUATIC ORGANISMS. Proc. 12th Industr. Waste Conf., Purdue Univ. Engng Extn Ser. No. 94, pp. 165-176. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 368. 1959.

Experiments were carried out to determine the effect of periodic low concentrations of oxygen on the tolerance to various chemicals of the bluegill sunfish, Lepomis macrochirus, and a pulmonate snail, Physa heterostropha. It was thought useful to include a pulmonate snail, as many of these animals rarely or never come to the surface for air. The chemicals tested were potassium dichromate, zinc chloride, naphthenic acid, and potassium cyanide, only the latter two chemicals being tested on the snail. Experimental procedure is described in detail, and the results are summarized in tables. It was found that periodic low concentrations of dissolved oxygen, such as may occur in streams during the night, decreased the tolerance of bluegill to zinc chloride, naphthenic acid, and potassium cyanide, but had no effect on the toxicity of potassium dichromate. The tolerance of snails to naphthenic acid and potassium cyanide was also lowered, except in tests using a race of snails from deep ponds with a low concentration of dissolved oxygen. In addition to reduced tolerance, the effect of periodic low concentrations of oxygen was to reduce considerably the range between the highest concentration allowing survival and the lowest concentration causing death.

2446. Hynes, H. B. N. 1958. THE BIOLOGICAL EFFECTS OF WATER POLLUTION. Paper presented at a Symposium on the Effects of Pollution on Living Material, held by the Institute of Biology in London, September 1958. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 371. 1959.

The author reviews the biological effects of pollution of lakes and rivers by toxic substances, inert suspended solids, organic matter, non-toxic salts, compounds which cause simple de-oxygenation of the water, and heated discharges. The two main effects of pollution appear to be either a simple elimination of some species, often accompanied by a corresponding increase in the remaining species, or a replacement of the normal aquatic community by another which is adapted to the peculiar ecological conditions.

2447. Westlake, D. F. 1958. THE EFFECTS OF BIOLOGICAL COMMUNITIES ON CONDITIONS IN POLLUTED STREAMS. Paper presented at a Symposium on the Effects of Pollution on Living Material, held by the Institute of Biology in London, September 1958. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 372. 1959.

Some effects of aquatic organisms on polluted streams are discussed briefly, including the effect of large populations of bottom fauna and of macrophytic vegetation on the oxygen balance; the physical effects of plant growth such as a reduction in rate of flow and increase in depth; and the accumulation of radioactive isotopes by plants.

2448. Newell, G. E. 1958. POLLUTION AND THE ABUNDANCE OF ANIMALS IN ESTUARIES. Paper presented at a Symposium on the Effects of Pollution on Living Material, held by the Institute of Biology in London, September 1958. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 373. 1959.

The effects of pollution of estuaries on aquatic fauna may be much more complex than in the case of pollution of rivers. Many estuarine animals, such as polychaete worms, can grow well in water which contains only 1/5 of the saturation value of oxygen, and the presence of organic matter and of increased concentrations of phosphate and nitrate favours the growth of phytoplankton. In addition, the resulting deposits may be more favourable to burrowing animals than are clean sands. However, other polluting material, such as toxic substances, has a deleterious effect in estuaries even when greatly diluted. The importance of studying the tidal currents in estuaries, to determine where pelagic larvae may be carried and to assess the effect on fisheries of the effluents borne by these currents, is stressed. The effect of heated discharges on the fauna is considered briefly.

2449. Warren, C. E., and P. Doudoroff. 1958. THE DEVELOPMENT OF METHODS FOR USING BIO-ASSAYS IN THE CONTROL OF PULP MILL WASTE DISPOSAL. T. A. P. P. I., 41, No. 8, pp. 211A-216A. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 377. 1959.

The authors describe experiments being carried

out at Oregon State College on the bio-assay of waste waters from the manufacture of cellulose, to determine the permissible concentrations of such waste waters which may be discharged to streams. Young guppies are used as the test animals; the test procedure is described in detail. The method used for determining the "application factor", by establishing a definite relation between the results of short-term tests and the long-term effects of the waste waters on the biota of the receiving stream, is also discussed. For this purpose, use is made of artificial streams, made from wooden troughs containing stream bottom materials and river water which is renewed continually, the various freshwater animals and plants are introduced. The effect of adding the desired concentration of waste water to the river water can then be observed. The problem of slime growths in streams receiving pulp mill wastes is discussed; methods are being developed to study the slime-production potential of waste waters from different mills.

2450. Limbaugh, C. 1957. MARINE OUTFALL STUDIES BY QUALIFIED DIVING INVESTIGATORS. Proc. 12th Industr. Waste Conf., Purdue Univ. Engng Extn Ser. No. 94, pp. 210-216. Water Pollution Abstracts, Vol. 32, No. 2, Abst. No. 378. 1959.

In California, diving investigations are being used to supplement surface studies on the effect of sewage and industrial effluents discharged to marine coastal waters. Examples of some investigations carried out by divers are described. Divers are able to collect representative samples of the bottom communities surrounding outfalls, to analyze these communities, to observe the path of the effluent and the movement of particulate matter and to assess some of the oceanographic and bottom conditions. The evidence obtained indicates that the effluents from the larger outfalls are adversely affecting the biota in specific areas. Various methods for reducing inshore pollution have been suggested, including extension of outfalls, diffusion of the effluent to provide greater dilution, placing the outfalls at the heads of submarine canyons, placing them in rocky areas where turbulence insures better mixing, additional treatment of the effluent before discharge, and increasing the depth of the discharge. None of these methods is completely satisfactory.

2451. Deufel, J. 1958. THE ECOLOGY OF SOME TYPES OF PSEUDOMONAS IN THE UPPER LAKE OF LAKE CONSTANCE. Z. Fisch Hilfswiss, 6(N. F.), pp. 635-638. Water Pollution Abstracts, Vol. 32, No. 3, Abst. No. 455. 1959.

An investigation is described of the most common types of Pseudomonas in the upper lake of Lake Constance. This bacterium is more common near the banks than in the open lake and in the open lake is more frequently found in winter than in summer. Strains of Ps. ureae were found which differed in physiological and morphological characteristics from known forms. Ps. punctata, which causes disease of fish, seldom appeared. The numbers of Pseudomonas types were too small in comparison with those of other bacteria for them to play any great part in the condition of the lake.

2452. Davis, D. S. 1958. OXYGEN DISSOLVED IN WATER. Wat. & Sewage Wks, No. 105, p. 287. Water Pollution Abstracts, Vol. 32, No. 3, Abst. No. 466. 1959.

A nomograph is presented for use in the determination of oxygen dissolved in water by the dropping mercury electrode method of Ippen and Carver. It simplifies the computation of oxygen concentration in mg per litre from determinations of temperature and microammeter readings.

2453. Agafanov, B. M. 1957. SOME EXPERIMENTS IN BIOLOGICAL DE-ACTIVATION OF (RADIOACTIVE) WATER. LABORATORY TESTS IN SMALL TANKS. Trud. Vses. Konf. Med. Radiol., Vopr. Gig. Dozimetr., pp. 79-82. Water Pollution Abstracts, Vol. 32, No. 3, Abst. No. 553. 1959.

Experiments were made to study the distribution of radioactivity in the living and non-living components of reservoirs. Strontium, ruthenium, cerium and caesium were introduced into the first of a series of 10 tanks containing sand, soil and some lake plankton. Samples were taken from each tank at intervals, and the radioactivity measured. The radioactivity in the water decreased gradually through the tanks, until the water in the last tank contained only 0.2-2.0 percent of the original activity due to strontium and ruthenium. The greatest proportion of the activity was absorbed by the organisms present, with the exception of caesium which was absorbed more strongly by soil and sand.

2454. Saurov, M. M. 1957. RADIOACTIVE CONTAMINATION OF FISH IN WATERS CONTAINING STRONTIUM. Trud. Vses. Konf. Med. Radiol. Vopr., Gig. Dozimetr., pp. 66-73. Water Pollution Abstracts, Vol. 32, No. 3, Abst. No. 554. 1959.

Experiments were carried out on the uptake of radioactive strontium by 4 species of fish kept in water containing different concentrations of strontium-90. It was found that considerable amounts of strontium-90 were taken up over prolonged periods, and there was a direct relation between the concentration of strontium-90 in the tissues, the activity of the water, and the period of exposure. The uptake of strontium was inversely proportional to the concentration of calcium in the water. Greater amounts of strontium were accumulated in the scales and bones than in the muscles and internal organs. Maximum permissible concentrations for radioactive strontium in open water reservoirs were established.

2455. Itazawa, Y. 1957. GAS CONTENT OF THE BLOOD IN RESPONSE TO THAT OF MEDIUM

WATER IN FISH. Bull. Jap. Soc. Sci. Fish, No. 23, pp. 71-80. Water Pollution Abstracts, Vol. 32, No. 3, Abst. No. 556. 1959.

Experiments are reported in which the oxygen and carbon dioxide contents of the caudal artery, caudal vein, and heart of carp were compared with the oxygen tension of the water. Details are given of the precedures used in extracting and analyzing the samples of blood and the results of the analyses are tabulated. Changes in the oxygen content of the blood in relation to the oxygen tension of the water are shown graphically. The oxygen content of arterial blood increased with oxygen tension up to about 80 mm of mercury, and ranged between 0 and 9.54 per cent by volume. When the oxygen content of the arterial blood decreased to less than 2 per cent by volume, the carp showed symptoms of dyspnoea, such as surfacing; this corresponds to an oxygen tension in the water of about 15 mm of mercury. The oxygen content of venous blood was low whatever the oxygen tension of the water, and showed no clear relation to the oxygen tension. The carbon dioxide contents of venous and arterial blood were similar; they generally decreased as the oxygen tension of the water decreased, and ranged between 1.89 and 58.67 per cent by volume. The oxygen content, which had decreased in the arterial blood of fish kept in still water, recovered in a short time after transferring the fish to running water; and the carbon dioxide content increased to the initial level after 24 hours.

2456. Lund, J. W. G., C. Kipling, and E. D. Le Cren. 1958. THE INVERTED MICROSCOPE METHOD OF ESTIMATING ALGAL NUMBERS AND THE STATISTICAL BASIS OF ESTIMATIONS BY COUNTING. Hydrobiologia, Vol. 11, No. 2, pp. 143-170. Biological Abstracts, Vol. 33, No. 1, Abst. No. 55. 1959.

Various methods for the estimation of populations of algae and other small freshwater organisms are described. A method of counting is described in detail. It is basically that of Utermohl and uses an inverted microscope. If the organisms are randomly distributed, a single count is sufficient to obtain an estimate of their abundance and confidence limits for this estimate, even if pipetting, dilution or concentration are involved. The errors in the actual counting and in converting colony counts to cell numbers are considered and found to be small relative to the random sampling error. Data are also given for a variant of Utermohl's method of using a hemocytometer for the larger plankton algae. (Auth. summ.)

2457. Haggqvist, G., and G. Hevesy. 1958. THE COMBINED EFFECT OF HEAVY WATER AND ROENTGEN IRRADIATION ON THE ANIMAL ORGANISM. Acta Radiol., Vol. 49, No. 4, pp. 321-325. Biological Abstracts, Vol. 33, No. 1, Abst. No. 411. 1959.

Fish (Hyphessobrycon scholzei) irradiated in 25% heavy water with 2500 and 3000 r and kept in tap water after irradiation are more damaged than when exposed to irradiation in tap water. The half-life time of fish after exposure to 2500 r in tap water is to 51 days, in 25% heavy water to 37 days. The corresponding figures after 3000 r are 22 and 15. (K. W. B.)

2458. Wilber, Charles G. 1958. CHROMATIC RESPONSES OF FUNDULUS TO LYSERGIC ACID. Amer. Jour. Physiol., Vol. 194, No. 4, pp. 488-490. Biological Abstracts, Vol. 33, No. 1, Abst. No. 450. 1959.

Lysergic acid diethylamide (LSD) was administered to Fundulus heteroclitus by injection and by immersion. In all experiments light-adapted fish became darker: the concentrated melanophores were dispersed. The degree of dispersal was directly related to the dose by a nearly straight line. A few behavioral changes in the fish were observed. If immersed in suitable concentrations of the drug in sea water, Fundulus absorbed a sufficient amount, probably through the respiratory surfaces of the gills, to disperse the melanophores. To darken immersed fish, a 1-hour ct (concentration X time) of 120,000 mg min/m^3 is required. Apparently the drug exerts a depressant action on specific loci in the brain from which the melanophore-concentrating fibers originate; this action allows the melanophore-dispersing fibers to darken the fish. (Auth. abst.)

2459. Beck, William M., Jr. 1958. A STUDY OF THE INTERRELATIONS OF SELECTED CHEMICAL AND PHYSICAL FACTORS IN THE SUWANEE RIVER. Quart. Jour. Florida Acad. Sci., Vol. 21, No. 1, pp. 12-24. Biological Abstracts, Vol. 33, No. 1, Abst. No. 539. 1959.

A study of the correlations, positive and negative, between chemical and physical factors in the Suwanee River. The source of these correlations lies in the mixing of two chemically distinct water masses, one highly variable quantitatively and the other relatively constant. (Auth. abst.)

2460. Morgan, G. D. 1958. A STUDY OF SIX DIFFERENT POND STOCKING RATIOS OF LARGEMOUTH BASS, MICROPTERUS SALMOIDES (LACEPEDE), AND BLUEGILL, LEPOMIS MACROCHIRUS (RAFINESQUE); AND THE RELATION OF THE CHEMICAL, PHYSICAL AND BIOLOGICAL DATA TO POND BALANCE AND PRODUCTIVITY. Jour. Sci. Lab. Denison Univ., Vol. 44, pp. 151-202. Biological Abstracts, Vol. 33, No. 1, Abst. No. 556. 1959.

Stocking with the ratio of 200 bass and 1000 bluegills gave the best balance in terms of harvestable fishes. Fastest growth of both species occurred during the first year. The zooplankters (rotifers, copepods, cladocerans ostracods) were most abundant at 38°-54°F. and when the dissolved oxygen was 8.9-10.3 ppm, with high turbidity; and least abundant at 63°-74° and 2-8.8 ppm oxygen. (B. F. H.)

2461. Vladykov, Vadim D. 1956. DISTANT RECAPTURES OF SHAD (ALOSA SAPIDISSIMA)

TAGGED IN QUEBEC. Naturaliste Canadien, Vol. 83, No. 10, pp. 235-249. Biological Abstracts, Vol. 33, No. 1, Abst. No. 561. 1959.

In 1945-1950, 2223 shad were tagged in Quebec waters. The main tagging station was established at Isle Verte in the St. Lawrence River about 150 miles east of Quebec City. Isle Verte is located in an important path of shad migration to and from the St. Lawrence River. Along the south shore of this island are built several small herring traps made of fascines, locally known as peches, where many shad are taken yearly. Eighty-five percent of the total tagged shad were released there. The majority of shad were marked with a metallic (monel or nickel) strap bent into the shape of a ring. A small number were marked by a tag consisting of a split stainless ring and vinylite plate. There was no great difference in the returns among the fish marked by the two tags. During the first four years, 1945-1948, 105 fish (5.7%) were recovered, 4 being outside of the Province of Quebec. The farthest recovery was at Cape Cod. In the three succeeding years, nine more fish were reported from several areas outside of the Province of Quebec. The longest period spent in water previous to recapture was four years and 12 days. This shad was tagged on June 4, 1947 at Isle Verte and was recaptured on June 15, 1951 at St. Vallier, about 100 miles west of the original tagging station. It was a male which had grown only 3 cm in form length. The recaptured fish did not display any great injury by the strap tag placed on its lower jaw. Two other shad, marked with split ring tags and liberated outside of one of the peches at Isle Verte on May 29, 1950, were recaptured in this same peche during the 2d week of June, 1954, after being in the water about 10 days longer than 4 years. (Auth. summ.)

2462. Wallen, I. E., W. C. Green, and R. Lasater. 1957. TOXICITY TO GAMBUSIA AFFINIS OF CERTAIN PURE CHEMICALS IN TURBID WATERS. Sewage and Indust. Wastes, Vol. 29, No. 6, pp. 695-711. Biological Abstracts, Vol. 33, No. 1, Abst. No. 562. 1959.

Studies were made of the short term toxicity of 86 chemicals encountered in refinery wastes on the livebearing mosquito fish (G. affinis). Oklahoma streams frequently contain considerable natural turbidity so that studies were also made to determine toxic levels of subsoil clays. Median tolerance limit (TLm) at 2 hours of 5 representative clays exceed 250,000 ppm, which is far above the maximum turbidity of 18,000 ppm recorded in Oklahoma. Experimental results are compared with TLm data for other test fish (bluegills, goldfish, creek chub, sunfish, trout, shiners, etc.) drawn from an extensive bibliography. (I. G.)

2463. Duncan, D. W., and H. L. A. Tarr. 1958. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. III. CHANGES IN THE PROTEIN AND NON-PROTEIN NITROGEN FRACTIONS IN MUSCLES OF MIGRATING SOCKEYE SALMON. Canadian Jour. Biochem. and Physiol., Vol. 36, No. 8, pp. 799-803. Biological Abstracts, Vol. 33, No. 1, Abst. No. 633. 1959.

The nitrogen content of three protein fractions and one non-protein nitrogen fraction of muscles of migrating sockeye salmon was determined at three points on the migratory route. The results have been expressed as milligrams of nitrogen per 100 g. of muscle, as per cent of the total muscle nitrogen, and as grams of nitrogen per average (standard) male or female fish. (Auth. abst.)

2464. Idler, D. R., and H. Tsuyuki. 1958. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. I. PHYSICAL MEASUREMENTS, PLASMA CHOLESTEROL, AND ELECTROLYTE LEVELS. Canadian Jour. Biochem. and Physiol., Vol. 36, No. 8, pp. 783-791. Biological Abstracts, Vol. 33, No. 1, Abst. No. 648. 1959.

Physical measurements have been made on all major organs and tissues of a pure race of migrating adult Oncorhynchus nerka. The data show that the population was sufficiently uniform in size that average weights and measurements performed on fish taken at three locations on the migration route quite accurately represented a standard fish of both sexes. The results will enable chemical analyses to be interpreted as changes in absolute amounts of a given tissue component rather than only on a percentage basis. The merits of this approach to an evaluation of changes in migrating salmon is demonstrated by the magnitude of the weight changes in many tissues during the 715-mile migration. A standard male lost only 11% of its body flesh whereas a standard female lost 30%. The alimentary tract decreased to one sixth of the initial weight. The milt increased by 50% while the roe increased by 272%. Thus, it is apparent that percentage composition data cannot show quantitative changes in a fish as it moves up the river. The results are discussed in relation to the findings of others on Salmonidae. Plasma cholesterol, magnesium, calcium, sulphate, and urea levels were measured on pooled blood samples from the 216 fish. (Auth. abst.)

2465. Wood, J. D. 1958. BIOCHEMICAL STUDIES ON SOCKEYE SALMON DURING SPAWNING MIGRATION. IV. THE NON-PROTEIN NITROGENOUS CONSTITUENTS OF THE MUSCLE. Canadian Jour. Biochem. and Physiol., Vol. 36, No. 8, pp. 833-838. Biological Abstracts, Vol. 33, No. 1, Abst. No. 701. 1959.

The non-protein nitrogenous constituents of muscle of migrating sockeye salmon were investigated. These constituents were found to be the same in both male and female fish and were present in approximately the same amounts in both sexes. The histidine content of the muscle in all fish decreased to one-fifth of the original value during the early stage level thereafter. Some of the other constituents changed to a smaller extent, usually increasing in later stages of the migration. This was especially

noticeable in female fish. However, the increase in the concentration of these constituents in the muscle was due to a decrease in the amount of muscle in the fish rather than to an increase in the amounts of the compounds themselves. (Auth. summ.)

2466. Arvy, L., M. Fontaine, and M. Gabe. 1956. MODIFICATIONS IN THE HYPOTHALAMOHYPOPHYSIAL NEUROSECRETORY TRACT IN S. SALAR DURING THE LIFE CYCLE. (MODIFICATIONS DE LA VOIE NEURO-SECRETRICE HYPOTHALAMO-HYPOPHYSAIRE DE SALMO SALAR L AU COURS DU CYCLE EVOLUTIF.) Compt. Rend. Assoc. Anat., Vol. 42, No. 88, pp. 224-233. Biological Abstracts, Vol. 33, No. 1, Abst. No. 1470. 1959.

Histological comparison has been made of this tract in the parr, the smolt, the spawning-salmon and in the mended, after fixation by the Bouin and paraldehyde-fuchsin or chrome hematoxylin-phloxin staining. Neuro-secretory product appears in pericaryones of nucleus preopticus four days after hatching; it appears four days later in the hypophysis. Immersion of sea or freshwater Teleosteans in hypertonic solutions provokes the migration of the neurosecretory product along a proximodistal way, but in the salmon, the same modifications appear during the catadromic migrations before the fish pass from fresh water to sea water. (Auth. abst.)

2467. Tuge, Hideomi Akira II, Yukitaka Kanayama, and Hidemasa Ochiai. 1955. STUDIES OF THE CONDITIONED REFLEX IN THE LOWER VERTEBRATES. I. GOLDFISH AND SEA BREAM (PAGROSOMUS MAJOR). Sci. Repts. Tohoku Univ., Ser. 4 Biol., Vol. 21, Nos. 3/4, pp. 227-240. Biological Abstracts, Vol. 33, No. 1, Abst. No. 1517. 1959.

The conditioned connection of light with food is established after a relatively small number of repetitions both in goldfish and Pagrosomus major. Conditioning in the goldfish varies considerably among the individuals experimented upon but once established it persists for a surprisingly long period of time. In goldfish, a positive food conditioned reflex can be altered to a negative conditioned reflex by applying light without reinforcement of food. The intensity of the reflex both in excitation and inhibition fluctuates; that is, the processes of excitation and inhibition occur alternately, though not in regular form. It requires a long time for the conditioned reflex to be completely extinguished when a fish with a stable conditioned connection is left alone but an inhibitory process may occur in the course of extinction. In Pagrosomus, the ability to differentiate between green and red lights is produced quickly. However, a conditioned reaction which has been differentiated is very difficult if not impossible to reverse. The possibility of alteration of differentiation may be taken as an important index in regard to the mobility of higher nervous activity in fish. (Auth. summ.)

2468. Tuge, Hideomi, and Hidemasa Ochiai. 1956. STUDIES OF THE CONDITIONED REFLEX IN THE LOWER VERTEBRATES. II. EARLY DEVELOPMENT OF THE DEFENSIVE CONDITIONED REACTIONS IN FISH LARVAE. Sci. Repts. Tohoku Univ. Ser. 4 Biol., Vol. 22, No. 1, pp. 21-28. Biological Abstracts, Vol. 33, No. 1, Abst. No. 1518. 1959.

A defensive conditioned reflex was established in the larvae of both Lebistes reticulatus and Oryzias latipes in early stages of development by combining an unconditioned stimulus (electric current) and a conditioned stimulus (light). Lebistes is an ovoviviparous and Oryzias an oviparous animal. In Lebistes, larvae two days old are likely to begin to obtain the ability to form a defensive conditioned reflex, while, in those after the third day of their birth, the conditioned connection is established without exception by several repetitions of reinforcement. In larvae about six days old, the intensity of the conditioned reflex seems to almost equal that in an adult guppy. At about the same stage a conditioned reflex which has been established appears to remain till the following day. In Lebistes, the defensive conditioned reflex which has been established in the early stages of the larvae was extinguished by application of conditioned stimuli without reinforcement. It was also extinguished when the larvae were left alone. In both cases, it required many applications of conditioned stimuli, and took considerable time to extinguish the conditioned reflex completely. The results demonstrate the existence of an internal inhibition process even in the early stages of the larvae. In Oryzias latipes, the defensive conditioned reflex was established for the first time in larvae about nine days old. The genesis of the defensive conditioned reflex as such is substantially similar to that observed in the larvae of Lebistes.

2469. Swarup, H. 1958. STATES IN THE DEVELOPMENT OF THE STICKLEBACK GASTEROSTEUS ACULEATUS (L). Jour. Embryol. and Exptl. Morphol., Vol. 6, No. 3, pp. 373-383. Biological Abstracts, Vol. 33, No. 1, Abst. No. 1978. 1959.

G. aculeatus is potentially valuable for the experimental study of the development of teleost fish. It breeds mainly during April and May but in the laboratory it is possible to bring it into breeding condition during most of the year. The female lays about 100 to 150 eggs which remain together surrounded by mucous. Each egg measures 1.2 to .17 mm in diameter. The entire development takes 22 to 24 days at 18°-19°C. For experimental purposes a table of normal development is provided, in 31 easily recognizable morphological stages, from fertilization to post-hatching. (Auth. abst.)

2470. Srinivasachar, H. R. 1956. DEVELOPMENT OF THE SKULL IN CATFISHES. I. DEVELOPMENT OF CHONDROCRANIUM IN SILONIA, PANGASUS AND AILIA (SCHILBERDAE). Proc. Natl. Inst. Sci. India. B: Biol. Sci., Vol. 22, No. 6, pp. 335-356. Biological Abstracts, Vol. 33, No.

1, Abst. No. 2033. 1959.

The chondrocranium in Silonia silondia, Pangasius pangasius and Ailia coila was studied and three stages of development of chondrocranium in the first and one stage in each of the second and third species are described. Based on these studies it is suggested that Silonia and Pangasius may be included in the same genus Pimelodus as two different species as was done by Hamilton in his book on the Gangetic fishes. (C.S.K.R.)

2471. Ross, A. John, and Thomas J. Parisot. 1958. RECORD OF THE FUNGUS ICHTHYOSPORIDIUM CAULLERY AND MESNIL, 1905, IN IDAHO. Jour. Parasitol., Vol. 44, No. 4, pp. 453-454. Biological Abstracts, Vol. 33, No. 1, Abst. No. 2381. 1959.

Ichthyosporidium Caullery and Mesnil (=Ichthyophonus, Plehn and Mulsow) is described from extensive liver and kidney lesions in the rainbow trout (Salmo gairdnerii). (Auth. abst.)

2472. Dence, Wilford A. 1958. STUDIES ON LIGULA-INFESTED COMMON SHINERS (NOTROPIS CORNUTUS FRONTALIS AGASSIZ) IN THE ADIRONDACKS. Jour. Parasitol., Vol. 44, No. 3, pp. 334-338. Biological Abstracts, Vol. 33, No. 1, Abst. No. 3671. 1959.

Larvae of Ligula intestinalis are reported as found almost exclusively in many common shiners in the lake investigated. The infected fish were partial to very shallow water over sandy bottom. The report contains information on the degree of infestation, the effect on the host species and the probable definitive hosts. (Auth. abst.)

2473. Scott, W. B. 1958. A CHECKLIST OF THE FRESHWATER FISHES OF CANADA AND ALASKA. Royal Ontario Museum, Toronto, Canada. 30 pgs. Biological Abstracts, Vol. 33, No. 1, Abst. No. 4047. 1959.

The purposes of this list are to collect the scattered records of older checklists, numerous regional works, and distributional records in various journals of freshwater fish fauna as well as to summarize the nomenclature changes affecting the names of freshwater fishes in Canada. The Petromyzonidae through Gasterosteidae are covered. A list of literature is cited. (From auth. intro.)

2474. Picotti, M. 1957. THE DEVELOPMENT OF OCEANOGRAPHY AND ITS PROGRESS DURING THE LAST HALF-CENTURY (LO SVILUPPO DELLA OCEANOGRAFIA E IL SUO PROGRESSO NELL' ULTIMO CINQUANTENNIO). Scientia (Milan), Vol. 92, No. 11, pp. 281-290. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4191. 1959.

An historical note; no references.

2475. Greenwald, Margaret. 1956. LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE. Chipman Chemical Company, Inc., Bound Brook, New Jersey, 22 pgs. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4222. 1959.

This list includes all references in the 1954 list and replaces it. Free on request to author.

2476. Greenwald, Margaret. 1957. SUPPLEMENT TO THE LIST OF REFERENCES ON CONTROL OF AQUATIC PLANTS, INCLUDING ALGAE. Chipman Chemical Company, Inc., Bound Brook, New Jersey. 12 pgs. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4223. 1959.

Free on request to author.

2477. Cole, Vernon W., and William M. Lewis. 1958. THE REMOVAL OF RESIDUAL CHLORINE FROM TAP WATER THAT IS TO BE USED IN AQUARIA. Turtox News, Vol. 36, No. 8, pp. 204-206. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4233. 1959.

Aging, aeration, filtration, and treatment with sodium thiosulfate are effective methods. Features of each method are discussed. (R.W.D.)

2478. Various Authors. 1957. THE EFFECTS OF ATOMIC RADIATION ON OCEANOGRAPHY AND FISHERIES. National Academy of Sciences, National Research Council: Washington, D. C., Publication No. 551, 137 pgs. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4522. 1959.

The report of the Committee on Effects of Atomic Radiation on Oceanography and Fisheries contains chapters on the following topics: General considerations by R. Revelle and M. Shaefer; Properties of atomic wastes by C. Renn; Natural radiation of selected organisms by T. Folsom and J. Harley; Disposal of radioactive wastes in the sea, effects of time and mixing characteristics by H. Craig; Transport and dispersal in the sea by W. Wooster and B. Ketchum; Ecological systems and transport in the sea by B. Ketchum; Precipitation on the ocean bottom by D. Carritt and J. Harley; Ecology of uptake by aquatic organisms by L. Krumholz, et al; Laboratory experiments on uptake by H. Boroughs, et al; Uptake by fresh water organisms by L. Krumholz and R. Foster; Radiation of aquatic organisms by L. Donaldson and R. Foster; Trace studies of the sea and atmosphere by H. Craig; Tagged water masses for studying the oceans by T. Folsom and A. Vine; and Large scale biological experiments with tracers by M. Shaefer. (R.L.S.)

2479. Wilke, Ford, and A. J. Nicholson. 1958. FOOD OF PORPOISES IN WATERS OFF JAPAN. Jour. Mammal, Vol. 39, No. 3, pp. 441-443. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4605. 1959.

Stomachs of 86 true porpoises (Phocoenoides truei) and 7 Dall porpoises (Phocoenoides dalli) from waters up to 1500 fathoms deep off northern Japan contained, by volume, lantern fish (Myctophidae), 75%; a gadid (Laemonema), 11%; squid (Ommastrephes and Watasenia, 11%; a sudid (Sudidae), 4%; and mackerel (Scomber), 1%. Food is nearly identical in species and volume with that found in a collection of 28 Phocoenoides taken in

1949 and 1950; hence, the sample probably shows their food accurately for the season and areas represented. (Auth. summ.)

2480. Deiler, Frederick G. 1958. VEGETATION MANAGEMENT OF STORAGE WATER RESERVOIRS AT GARDEN ISLAND BAY. Proc. Louisiana Acad. Sci., Vol. 20, pp. 24-35. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4650. 1959.

Attempts to reduce vegetation in freshwater reservoirs with chemicals and burning were largely unsuccessful, but invasion by nutria (Myocastor coypus) solved the problem. (G. H. P.)

2481. Fish, G. R. 1956. CHEMICAL FACTORS LIMITING GROWTH OF PHYTOPLANKTON IN LAKE VICTORIA. East African Agric. Jour., Vol. 21, No. 3, pp. 152-158. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4652. 1959.

There appears to be a shortage of soluble sulphates throughout the African continent. The evidence was based mainly upon chemical analyses of water and soils. The experiments described show that a shortage of sulfates is likely to be limiting the growth of phytoplankton in Lake Victoria. Sulfur is an essential constituent of certain amino acids and phyotplankton may be existing in a marginal concentration of dissolved sulfate. The suggestion has been put forward that those fish feeding almost wholly on these plants might have a retarded growth rate. The problem may therefore have an economic aspect, for there is an acute shortage of protein in the diet of the local natives, and the most important fishery of Lake Victoria is based on Tilapia species which are plankton feeders. The sulfur cycle is undoubtedly of considerable importance in Lake Victoria. The importance of N and P cannot be dismissed, but whereas, during certain periods, phosphate and ammonia have been found in detectable quantities in the lake water, the content of sulfate has never reached this concentration. Fluctuations in sulfate concentration in the lake water are therefore not detectable. In this lake, the inflows are very small compared to its volume, and the analytical evidence indicates that the supply of sulfate from these sources is likely to be of minor importance. The bottom deposits, after drying, yield comparatively high quantities of sulfate (e.g. 0.25 mgm/gm dry weight), but although these would appear to be the obvious main source of supply of sulfates, experiments have failed to show that any considerable quantity is released to the water under natural conditions. The metabolic activity of certain mollusks has been shown to cause the release of certain quantities of sulfate into the surrounding water. It is extremely difficult, however, to estimate how significant the activities of these mollusks are to the biology of the lake as a whole, but there would seem to be little doubt that they help to maintain existing levels of fertility. The culture experiments described in this paper show that, as far as the test algae are concerned, sulphates are a limiting factor for plankton growth as well as nitrates and phosphates. If these conclusions can be confirmed using local phytoplankton species as test algae, then these salts must be regarded as playing a vital role controlling the biological productivity of Lake Victoria. (Auth. concl.)

2482. Hunt, Burton P. 1958. LIMNETIC DISTRIBUTION OF CHAOBORUS LARVAE IN A DEEP FLORIDA LAKE (DIPTERA). Florida Ent., Vol. 41, No. 2, pp. 111-116. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4659. 1959.

Larvae of the phantom midge, Chaoborus sp. were always encountered in plankton samples from the deeper waters of Deep Lake, Collier County. This is a meromictic, dichothermic lake with a surface area of about 1.6 acres and a maximum depth of about 95-98 feet. No dissolved O_2 occurs below a depth of about 18 feet. The daytime vertical distribution of the larvae was usually from 10 feet down to 90 feet. The smallest, hence youngest, larvae occupied the shallower strata while the larger ones occurred in the deeper waters. An increase in average length of the larvae was positively correlated with increase in depth. The calculated number of larvae/m^3 ranged as high as 6345. Since none were obtained from the bottom mud in the deeper regions, the larvae are considered to be entirely limnetic. (Auth. abst.)

2483. Ichimura, S., and Y. Aruga. 1958. SOME CHARACTERISTICS OF PHOTOSYNTHESIS OF FRESH WATER PHYTOPLANKTON. Bot. Mag. (Tokyo), Vol. 71, No. 841/842, pp. 261-269. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4660. 1959.

The relation of photosynthesis of natural phytoplankton to each environmental factor was discussed in detail on the basis of laboratory experiments. In eutrophic lake water, or in water enriched with nutrient salts, light saturation of photosynthesis occurred at about 15 klux. in Cyanophyceae communities, at about 10 klux. in Chlorophyceae, and at 7 klux. in Bacillariophyceae. Such light saturation, however, was found at low light intensity of about 4 klux., with phytoplankton in oligotrophic lake water. The highest photosynthetic activity of phytoplankton of about 8 mg O_2/mg chlorophyll/hour was measured in natural waters of eutrophic lakes. The activity in nesotrophic lake was about 4 mg O_2/mg chlorophyll/hour in oligotrophic lakes. The effect of supply of nutrient salts on photosynthesis of phytoplankton was not so remarkable in eutrophic lake waters as in oligotrophic ones. Potential photosynthetic activity of phytoplankton was almost constant throughout the year, for 2 spells in March and in August when heavy altering of constituent phytoplankters were going. (T.H.)

2484. Kaploysky, A. J. 1957. ESTUARINE POLLUTION INVESTIGATION EMPLOYING SAME-SLACK TECHNIQUE. Sewage and Indust. Wastes, Vol. 29, No. 9, pp. 1042-1053. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4662. 1959.

A study of horizontal and vertical sanitary water

quality patterns in the lower Delaware River employing the cross sectional procedure showed that representative data could be obtained using samples collected during either high- or low-water slack at surface level in the ship channel. A timed same-slack procedure produced results of even greater validity for establishing self-purification patterns in the lower Delaware River. This technique appears applicable to the entire estuary from Delaware Bay to Trenton. (I. G.)

2485. Owen, John B. 1958. THE EROSION-LITTORAL ZONE OF NORTH TWIN LAKE, AND ITS RELATION TO DREDGING. Iowa State Coll. Jour. Sci., Vol. 33, No. 1, pp. 91-102. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4667. 1959.

Fish life in this lake, a shallow prairie lake in Iowa, is subject to choking with emergent vegetation and annual winter kill. The ecological effects of dredging were studied by dredging only a portion of the lake and studying the biology of both the dredged and undredged portion. Study was instituted after the dredged portion had stabilized. On the basis of observations and data, recommendations are made with respect to general plans for preservation of the erosion-littoral zone both for fish life and recreational use. (G. H. N.)

2486. Paluch, J. 1956. DAILY VARIATIONS OF OXYGEN CONTENT IN THE WATERS OF THE RIVER BASIN (DOBOWE ZMIANY ZAWARTOSCI TLENU W WODZIE ZBIORNIKE RZECZNEGO). Polskie Arch Hydrobiol., No. 3, pp. 333-356. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4668. 1959.

Processes absorbing O_2 increase from summer to autumn irrespective of water temperatures. In the bottom strata, absorption of O_2 contained in the water was greater throughout all months in spite of the fact that the water basin is shallow and repeated full circulation of water took place many times during the summer. This fact proves that intensive metabolism takes place at the bottom due probably to the heating of bottom slime and to circulation of water causing aeration; this accelerates biochemical processes, among which microbiological play the main part. An interrelation was also found to exist between O_2 saturation, solarization and day length. Further investigations are being conducted in this same basin on metabolism in the daily cycle; these investigations include comparison of such parameters as: O_2, BOD_5, CO_2, redox potential, pH--with plankton and bacteria qualities. (Auth. summ.)

2487. Sublette, James E., and Mary Smith Sublette. 1958. THE PHYSICO-CHEMICAL FEATURES AND BOTTOM FAUNA OF CHAPLIN'S LAKE, NATCHITOCHES PARISH, LA. Proc. Louisiana Acad. Sci., No. 20, pp. 85-94. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4673. 1959.

The lake shows strong thermal gradients and partial stratification (maximum depth 4. 2 yards) from March through October. Associated with this period are lowered O_2 values although depletion never occurred. Bicarbonates accounted for most of the high alkalinity recorded. A diversified bottom fauna exists with most groups occurring in the littoral (0-1. 0 m) and relatively few in the profundal (2. 1-3. 0 m) zone. Mean annual standing crop was 21. 6 grams/m^2 in the littoral, 32. 5 grams/m^2 in the profundal. Numerically and volumetrically oligochaetes dominated the benthos with Tendipedidae and Chaoborus 2d and 3d. The annual cycle shows well developed cold season maxima and warm season minima in the littoral and ecotone communities. The profundal community was uniform. (G. H. P.)

2488. Swain, F. M., and R. W. Meader. 1958. BOTTOM SEDIMENTS OF SOUTHERN PART OF PYRAMID LAKE, NEVADA. Jour. Sediment. Petrol., Vol. 28, No. 3, pp. 286-297. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4675. 1959.

Fine ashy sands were found near the river mouth and diatomaceous, ostracodal, copropelic and sapropelic silt beyond. Wet sediments are less alkaline and have stronger reducing intensity than overlying waters; probable hydrocarbons are present. Amounts of amino acids and humic substances are reiminiscent of oligotropic lakes of north central U. S. The term "apatotrophic" is introduced for lakes of arid regions which have alkaline waters and high total dissolved solids but relatively low C and N content, and in which the sedimentary bitumens are characterized by relatively large amounts of pigmented organic substances. (From auth. abst.)

2489. Kosaka, M. 1956. EXPERIMENTAL STUDIES ON THE HABITAT PREFERENCE AND EVALUATION OF ENVIRONMENT BY FLATFISHES, LIMANDA YOKOHAMAE (GUNTHER) AND KAREIUS BICOLORATUS (BASILEWSKY). Bull. Japanese Soc. Sci. Fish., Vol. 22, No. 5, pp. 284-288. Biological Abstracts, Vol. 33, No. 2, Abst. No. 4679. 1959.

In an experimental pool provided with a bottom, half fine sand and half gravel, it was found that flatfish preferred sand bottom; but this tendency was more strongly shown when population density was low (1-4 fish to the pool). At the density of 4 fish or less, the preference for sand was 70 to $>$ 95%. At densities of 4-12 fish, the preference was 70 to 60%. (G. G.)

2490. Ramaswami, L. S., and B. I. Sundararaj. 1958. INDUCED SPAWNING IN THE CATFISH HETEROPNEUSTES WITH MAMMALIAN CHORIONIC GONADOTROPHINS. Acta Anat., Vol. 32, No. 3, pp. 231-234. Biological Abstracts, Vol. 33, No. 2, Abst. No. 5450. 1959.

Mammalian chorionic or placental gonadotropin preparations have been used to induce spawning in eggbound Heteropneustes during the nonbreeding season (December). Also progesterone and estrogens have been tried but without success. Injection

of 100-150 IU of Antuitrin S (chorionic gonadotropin) made the eggbound catfish yield viable eggs. Larger doses did not appear to be helpful. Antex (pregnant mares' serum gonadotropin) did not make the catfish ovulate. Antex followed by Physex (human chorionic gonadotropin), or Physex alone, made the eggbound catfish yield viable eggs hatching into fry.

2491. Olivereau, Madeleine. 1958. ANATOMICAL AND HISTOLOGICAL STUDY OF THE THYROID GLAND OF THE TUNA (T. THYNNUS AND G. ALALUNGA) (ETUDE ANATOMIQUE ET HISTOLOGIQUE DE LA GLANDE THYROIDE DU THON (THUNNUS THYNNUS L. ET GERMO ALALUNGA)). Bull. Soc. Zool. France, Vol. 82, No. 5/6, pp. 401-417. Biological Abstracts, Vol. 33, No. 2, Abst. No. 5482. 1959.

The thyroid glands of the red tuna (Thunnus thynnus) and of the white tuna (Germo alalunga) are described anatomically and histologically from serial sections. In both spp. the gland consists of 2 compact lobes, respectively anterior to the first and the second branchial arteries in the vicinity of the ventral aorta. Their morphology is reconstructed in detail. The histology also is described in detail. The histology and the rich capillary network suggests a notable secretory activity. (C. C. D.)

2492. Haynes, H. L., H. H. Moorefield, A. J. Borash, and J. W. Keays. 1958. THE TOXICITY OF SEVIN TO GOLDFISH. Jour. Econ. Ent., Vol. 51, No. 4, p. 540. Biological Abstracts, Vol. 33, No. 2, Abst. No. 7722. 1959.

Under controlled laboratory evaluation, goldfish tolerated over 200 times as much technical Sevin, 1-naphthyl N-methylcarbamate, in the water as technical DDT (LD_{50} Sevin = 28 ppm.; DDT = 0.11 ppm.). Tested as a 50% wettable powder, the toxicity of Sevin was increased (LD_{50} W. P. = 14 ppm.), whereas the other ingredients in the formulation were innocuous. (Auth. abst.)

2493. Bargetzi, J. P. 1958. USE OF BIOCHEMICAL METHODS OF ANALYSIS FOR A TAXONOMIC STUDY: THE COREGONES OF THE LAKE OF NEUCHATEL (APPLICATION DE METHODES D'ANALYSE BIOCHIMIQUE A ENU ETUDE TAXONOMIQUE: LES COREGONES DU LAC DE NEUCHA TEL). Experientia, Vol. 14, No. 5, pp. 187-188. Biological Abstracts, Vol. 33, No. 2, Abst. No. 8079. 1959.

An immunological method is described for differentiating between two forms of coregonines, Coregonus fera Jurine and C. macrophthalmus Nusslin. (A. A.)

2494. Berry, Frederick H. 1958. ADDITIONS TO THE FISHES KNOWN FROM THE VICINITY OF CEDAR KEY, FLORIDA. Quart. Jour. Florida Acad. Sci., Vol. 20, No. 4, p. 232. Biological Abstracts, Vol. 33, No. 2, Abst. No. 8081. 1959.

Two species of the family Carangidae, Caranx ruber (Bloch) and Seriola dumerili (Risso), are added to the established list of fishes. (Auth. abst.)

2495. Briggs, John C. 1958. A LIST OF FLORIDA FISHES AND THEIR DISTRIBUTION. Bull. Florida State Mus. Biol. Ser., Vol. 2, No. 8, pp. 223-318. Biological Abstracts, Vol. 33, No. 2, Abst. No. 8086. 1959.

The fish fauna of Florida is far richer than that of any comparable area in North or Central America. The 1120 spp which occur in Florida waters represent approximately one-fourth the number of spp. recorded for the entire northern portion of the Western Hemisphere. Seventy-four of these apparently have a worldwide (circumtropical) distribution, while 85 have been taken only from Florida waters. More fish spp. occupy the marine shore zone than are found in all other habitats combined. This shore fauna has a great deal in common with that of the West Indies, South America, and Bermuda, perhaps more than with the rest of North America. The surprising number of Florida shore spp. that range to the eastern Atlantic indicates a closer relationship to that area than was previously suspected. The Florida Keys contain the greatest variety of fishes in the state. The majority of the mainland forms occur in the Keys, and, in addition, approximately 135 spp. that inhabit the Keys do not occur on the mainland. A distinct difference is present between the Gulf and Atlantic coast faunas with the former being a good deal richer in number of spp. There is also a clear indication of a faunal difference between the northeastern and northwestern Gulf of Mexico. The rich freshwater fish fauna of the other southeastern states has been able to penetrate Florida to but a limited extent; almost all of those spp. present belong to 6 families of which the Cyprinodontidae, Centrachidae, and Ictaluridae have been the most successful invaders. A systematic list provides information about the range, habitat, and common name of each sp. A bibliography includes those references necessary for the identification of Florida freshwater, euryhaline, and marine shore fishes. (Auth. abst.)

2496. de Buen, Fernando. 1958. ICHTHYOLOGY: THE FAMILY ICTALURIDAE NEW TO THE ACCLIMATED FAUNA OF CHILE AND SOME CONSIDERATIONS ON THE INDIGENOUS SILUROIDEI. (ICTIOLOGIA: LA FAMILIA ICTALURIDAE NUEVA PARA LA FAUNA ACLIMATADA DE CHILE Y ALGUNAS CONSIDERACIONES SOBRE LOS SILUROIDEI INDIGENAS.) Invest. Zool. Chilenas, No. 4, pp. 146-158. Biological Abstracts, Vol. 33, No. 2, Abst. No. 8095. 1959.

Characters of the family are reviewed, and a specimen found in Chile is described under the name of Ictalurus melas, with statement that this genus has recently been synonymized with Ameirus. A key is given to separate it from several other spp. which are indigenous to Chile. A review is given of synonymy and Chilean distribution records for the families, genera, and spp. of Siluroidei or Nematognathi so far known from Chile. Besides

the sp. mentioned above, these include 1 sp. each of Diplomyste and Nematogenys, and 6 of Pygidium.

2497. Phillips, J. B. 1958. ROCKFISH REVIEW. California Dept. Fish and Game Fish. Bull. No. 105, pp. 7-25. Biological Abstracts, Vol. 33, No. 2, Abst. No. 8113. 1959.

The 52 spp. of rockfishes (Scorpaenidae) that occur in California ocean waters are listed and a uniform system of reporting spp. is proposed. Important spp., types of fishing gear, annual landings, areas of landing, products, and regulations are noted. A resume of life history studies indicates a paucity of research on nearly all species. (Auth. abst.)

2498. Faegri, Knut. 1955. A PRACTICAL SUGGESTION FOR DIATOM PREPARATIONS. Geol. Foren. Stockholm, Forhandl., Vol. 77, No. 1, pg. 119. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8369.

Diatoms in suspension in water may be transferred to a slide more evenly if a drop of commercial detergent is added to the water. (G. W. S.)

2499. Cachon, Jean. 1957. SOME TECHNICS FOR COLLECTING PLANKTON FOR BIOLOGICAL INVESTIGATION. (SUR QUELQUES TECHNIQUES DE PECHES PLANCTONIQUES POUR ETUDES BIOLOGIQUES.) Bull. Inst. Oceanogr. (Monaco), No. 1103, pp. 1-6. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8445. 1959.

A discussion of plankton nets.

2500. Cassie, R. Morrison. 1958. APPARATUS FOR INVESTIGATING SPATIAL DISTRIBUTION OF PLANKTON. New Zealand Jour. Sci., Vol. 1, No. 3, pp. 436-448. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8446. 1959.

The apparatus described is designed to study the "meso-distribution" of marine plankton and its relationship to the variable physical properties of sea water. "Meso-distribution" is defined as the spatial pattern which can be detected by horizontal sampling intervals not less than one metre and not greater than 100 metres. The investigation has been inspired by the marked departure from randomness shown by counts of replicate plankton samples, even in those from relatively (but not absolutely) homogeneous bodies of sea water. Temperature and salinity measurements can be made continuously in the same parcels of water from which the plankton is strained, and there is a possibility of measuring other variables by an extension of the same apparatus. Plankton is collected by a 1 1/2 in. diameter hose and centrifugal pump and filtered out on to bolting silk squares. Small samples (200 litres) of water are taken, and accurate total counts made of the organisms. Temperature is measured by a thermistor resistance thermometer, and salinity by conductivity measurement with a 4kd/s A. C. bridge, a conventional cell, and temperature compensation by a thermistor. Preliminary results are briefly discussed. (Auth. summ.)

2501. Gilmour, A. E. 1958. THE SUSPENDED PLUMMET METHOD FOR DENSITY MEASUREMENTS. New Zealand Jour. Sci., Vol. 1, No. 3, pp. 391-401. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8451. 1959.

An apparatus is described for measuring densities by a suspended plummet method. Applied to sea water, the densities of samples can be determined with an accuracy of 2×10^{-5} g ml^{-1} at the rate of sixty per day. (Auth. summ.)

2502. Richardson, William S., and Charles H. Wilkins. 1958. AN AIRBORNE RADIATION THERMOMETER. Deep Sea Res., Vol. 5, No. 1, pp. 62-71. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8467. 1959.

An airborne radiation thermometer for use in measuring sea surface temperatures from aircraft is described. Infra-red radiation from the water surface is compared to the radiation from a black body at known temperature within the instrument. The sensitivity is about 0.01°C. Errors attending such measurements are discussed, and several applications to oceanographic research are cited. (Auth. abst.)

2503. Andrew, F. J., and G. H. Green. 1958. SOCKEYE AND PINK SALMON INVESTIGATIONS AT THE SETON CREEK HYDROELECTRIC INSTALLATION. Progr. Rept. Internatl. Pacific Salmon Fish Comm., pp. 1-74. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8790. 1959.

Investigations conducted in 1956 and 1957 indicated that the potential production of sockeye and pink salmon in the Seton-Anderson watershed has been reduced by the construction of the Seton Creek hydroelectric installation. The upstream migration of adult salmon was not seriously impaired by the 25-foot diversion dam in Seton Creek, provided the radial gate was not used for spilling excess water. Mortality rates of sockeye smolts passing through the turbine, fish-water sluice and siphone were measured and it was estimated that the sockeye populations would be reduced by at least 10% and that portion of the pink salmon population originating above the Seton Dam would be reduced by possibly 13% as a result of mortalities suffered during the seaward migration to the dam and the powerhouse. Adult pink salmon destined for the Seton-Anderson watershed suffered an average delay of 1 day in the powerhouse tailrace but some individual pink salmon and late-running sockeye salmon were delayed for considerably longer periods. This delay occurred in spite of periodic powerhouse shutdowns and appeared to be related to the level of the Fraser River, the delay being greatest during low water. Some of the pink salmon and particularly Portage Creek sockeye salmon appeared to be seriously affected but further study is required for a more complete evaluation of this problem. Other factors adversely affecting salmon production include a reduction in pink salmon spawning areas and changes in the

environmental conditions in Seton Lake.

2504. Cole, B. Theodore, Hardy J. Bennett, and Jack D. Miller. 1958. TOLERANCE OF EURYHALINE FISH FORMS TO DILUTIONS OF OIL FIELD BLEED WATER. Proc. Louisiana Acad. Sci., No. 20, pp. 13-23. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8805. 1959.

Seven fishes were tested : Fundulus similis, F. grandis, Leiostomus zanthurus, Lagodon rhomboides, Micropogon undulatus, Cynoscion nothos, and Mugil cephalus. Survival of each is recorded for various periods of exposure (up to 8 days) in various dilutions of brine. (G.H.P.)

2505. de Godoy, M. P. 1957. TAGGING FISH IN THE MOGI GUACU RIVER. (MARCACAO DE PEIXAS NO RIO MOGI GUACU.) Rev. Brasil. Biol., Vol. 17, No. 4, pp. 479-490. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8810. 1959.

Of fishes tagged with a hydrostatic tag in the Mogi Guacu river at Cachoeira de Emas, recovered were of 1000 fishes placed there in 1954 7.2%, 8.3% of 1000 in 1955 and 10.1% of 3000 in 1956 at several places in the parent river, the Pardo river, the Grande, and their tributaries and marginal lagoons. Migration rates before spawning: (1) Curimbata (Prochilodus scrofa): average migration 10 to 16.5 km a day; (2) Dourado (Salminua maxillosus): average migration 10 to 12 km a day and (3) Mandi Amarelo (Pimelodus clarus): average migration 10-12.5 km a day. (W.G.H.)

2506. Dziekonska, J. 1956. STUDIES ON EMBRYONIC DEVELOPMENT OF FISH. I. OBSERVATIONS ON THE SPAWNING AND THE EMBRYONIC DEVELOPMENT OF BREAM IN THE VISTULA LAGOON (BADANIA NAD WCZESNYMI STADIAMI ROZWOJOWYMI RYB. I. ROZROD I ROZWOJ EMBRIONALNY LESZCZA (ABRAMIS BRAMA L.) W ZALEWIE WISLANYM.) Polski Arch. Hydrobiol., No. 3, pp. 291-305. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8814. 1959.

The paper contains the results of studies on spawning of bream (A. brama) in the Vistula River Lagoon, and on the embryonic development of this species in natural and experimental conditions. In the studies on the embryonic development of bream in natural conditions, the following factors were considered: influence of the depth of the spawning place, kind of substratum and water level fluctuations; in experimental conditions - the influence of temperature, salinity, light, and detaching of eggs from the substratum. Two different spawning places of bream were differentiated: one located near the shore at a depth of around 0.5 m, and a second at some distance from the shore at a depth of 1.5 m. The number of eggs in the shallow spawning place reached an average of 171 112/m^2 in the deeper -- 2000 eggs/m^2. An average of around 9 eggs were observed/10 lineal centimeters of dead rush stems. The following percentages of living eggs were observed in the spawning place located at a depth of 0.5 m: 80.4% of dead reed stalks, 85.9% of green plants, 86.6% on bottom fibrous algae; the percentage of living eggs on algae of the deeper spawning place was found to be 100%. Water level fluctuations over shallow spawning places result in the loss of notable quantities of eggs attached to plants immediately under the surface of the water due to drying at low water levels. Salinity around 6 °/oo inhibits the swelling of eggs. The time of embryonic development of bream up to hatching was 79 hours at 18.5-19.5°C; at 15-16° hatching was noted after 71.5 hours. The number of degree-hours for successive development stages is smaller at a higher than at a lower temperature. However, embryos developing in a temperature of 15-16°C hatch at earlier stages of development and die after hatching from the eggs. Limiting the respiratory surface of eggs through mutual adherence slows embryonic development and leads to the death of the embryo. Detaching eggs from the substratum accelerates embryonic development, but retards the process of hatching and may even render it impossible. (Auth. summ.)

2507. Hayashi, Shigeichi. 1957. A NOTE ON SCALES OF PINK SALMON. Bull. Tokai Reg. Fish. Res. Lab., No. 16, pp. 7-14. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8831. 1959.

Examinations were conducted on the scale characters and fork length of the pink salmon captured by the R. V. Tenyo Maru in the northern North Pacific from 1952 to 1954. Ridges of the scales were found coarsely arranged, and the winter zone was easily recognized. Except for the number of winter zones, the scales from various body parts of a specimen differed in some characters: including size, shape, ridge counts, and relative distance of the winter zone. All the pink salmon under study were in their 2d year of life. It is suggested that ridge counts, distance of the winter zone, and fork length, likely reflect changes in environmental conditions on the hatching and nursery grounds, vary depending on the year but not on the fishing ground. Hence these scale characters will provide valuable information for segregating broods among the fish captured in the waters under discussion, when sufficient samples become available in future surveys. (Auth. summ.)

2508. Mitani, Fumio. 1958. STUDIES ON THE MATURITY AND SPAWNING OF THE YELLOWTAIL, SERIOLA QUINQUERADIATA T. AND S., FOUND IN THE JAPANESE WATERS AND THEIR ADJACENT REGIONS. II. SPAWNING SEASON AND SPAWNING AREA. Japanese Jour. Ecol., Vol. 8, No. 2, pp. 53-62. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8856. 1959.

The writer discusses and surmises the spawning time by examining the monthly changes of mature gonads of fish obtained in several different regions around Japan, and the geographical distribution of the eggs and larvae of the fish in each month of the year.

2509. Munoz-Goyanes, Guillermo. 1958. POS-

SIBLE INTRODUCTION OF R. SAXATILIS INTO SPAIN (SOBRE LA POSIBLE INTRODUCCION EN ESPANA DEL ROCCUS SAXATILIS W). Montes (Madrid), Vol. 14, No. 79, pp. 27-34. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8861. 1959.

The fish is described and its life history and economic importance in the USA discussed. The author suggests that it might be introduced into Spain in the estuaries of rivers flowing into the Mediterranean, but only where there are no trout or salmon. (W. N. S.)

2510. Radhakrishnan, N. 1958. A CONTRIBUTION TO THE BIOLOGY OF INDIAN SAND WHITING--SILLAGO SIHAMA (FORSKÅL). Indian Jour. Fish., Vol. 4, No. 2, pp. 254-283. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8877. 1959.

Growth rates of various body parts were determined. Standard length had maximum and depth of body at pectoral fin had minimum rate of growth. Maturity seems to be attained at length of 13 cm. Rate of growth as determined by study of otoliths indicated increases of 4.24, 3.38, and 1.61 cm for first three years. Polychaetes are the main food, followed by crustaceans and fishes. Charts show seasonal fluctuations of food consumed. Feeding increases just after spawning and decreases before spawning. Spawning season appears to extend from August to February with peak in October. The ovary grows at greater rate than the testis. A fully mature ovary contains about 14,000 eggs. Sex ratio is 55.6 M: 44.4 F. The author believes that reduction of feeding at maturation may cause growth of rings in the otolith. Length-frequency distributions are given for the Gulf of Mannar and Polk Bay for one year. Notes on geographic distributor and fishing methods are given. (R. W. D.)

2511. Saha, K. C., D. P. Sen, A. K. Roy Chowdhury, and S. K. Chakravarty. 1958. STUDIES ON THE FACTORS INFLUENCING SPAWNING OF INDIAN MAJOR CARPS IN "BUNDH" FISHERIES. Indian Jour. Fish., Vol. 4, No. 2, pp. 284-294. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8881. 1959.

From study of physico-chemical conditions in 4 breeding Bundhs it was concluded that nearly neutral water with low alkalinity is favorable, cloudy days with thunderstorms seem to have some favorable influence, while temperature and O_2 content appear to have no influence in inducing spawning. (R. W. D.)

2512. Schmulbach, J. 1958. ANGLING SUCCESS ON THE DES MOINES. Iowa Conservationist, Vol. 17, No. 8, pp. 57, 63-64. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8885. 1959.

Systematic sampling on a 7-mile stretch of the Des Moines River revealed an average weekday pressure of 458 man hours and 820 man hours on weekend days. The average catch was 0.44 fish/hour, most of which were channel catfish, Ictalurus punctatus, and carp, Cyprinus carpio. (K. D. C.)

2513. Sommani, Ernesto. 1958. ECOLOGICAL AND ETHOLOGICAL CHARACTERISTICS OF THE RAINBOW TROUT (SALMO GAIRDNERII RICH.), IN RELATION TO ITS ESTABLISHMENT IN MOUNTAIN STREAMS (CARATTERISTICHE ECOETOLOGICHE DELLA TROTA IRIDEA (SALMO GAIRDNERII RICH.) IN RELAZIONE AI RIPOPOLAMENTI DEI CORSI D'ACQUA MONTANI.) Boll. Pesca, Piscicolt. e Idrobiol., Vol. 12, No. 1, pp. 92-99. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8894. 1959.

A study of the acclimatization of rainbow trout in mountain streams in many alpine localities has shown that the difficulties are not the result of unsuitable ecological conditions but of the presence of brown trout (S. trutta fario). Rainbow trout yield more than brown trout, and can reproduce under natural conditions where brown trout do not succeed, but the introduction of brown trout into streams where rainbow trout live, will cause the disappearance of the latter in a few years. (R. W. D.)

2514. Starmach, K. 1956. CHARACTERISTICS OF RIVERS FROM BIOLOGICAL AND FISHERY POINT OF VIEW. (RYBACKA I BIOLOGICZNA CHARAKTERYSTYKA RZEK.) Polskie Arch. Hydrobiol., No. 3, pp. 307-322. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8897. 1959.

The scheme of characterizing rivers from the point of view of their biology and fisheries initiated by Huet, based upon their gradients, has been applied to some Polish rivers, using maps on the scales of 1:75,000 and 1:100,000. In every river there is an area with rheophilous, and another with limnophilous biocoenoses. In the rheophilous area the river flows in cascades. In consequence we distinguish in a river lotic zones, with currents, and lenitic zones, without currents. Proceeding downstream from the source of the river the relation of these zones varies. It may be estimated by counting the places with and without current over a stretch of 100 m in small rivers, and over longer stretches in larger rivers. In mountain streams, in the trout zone, the ratio of the lotic to the lenitic reaches is 4:1, in the grayling zone it is 2:1, in that of the barbel it amounts to 1:2, and in the bream zone it is 1:4, or places with a river current are altogether absent. A provisional distribution of the phyto- and zoocoenoses in our rivers is as follows: (1) The microphyte reaches, at gradients ranging from 80 to 4 °/oo. (2) The transitory reaches, in which flowering plants appear beside the microphytes and grow in small aggregations or in clusters; the unitary gradients here range from 4 to 1 °/oo. (3) The macrophyte reaches, with flowering plants predominating; the unitary gradients are 1:0 °/oo. Furthermore we distinguish: (1) Reaches occupied almost entirely by a rheophilous fauna of invertebrates, at unitary gradients ranging from 80 to 4 °/oo, and thus corresponding to the microphyte reaches. (2) Reaches of mixed fauna including rheophilous animals in currents and limnophilous in quiet waters.

The unitary gradient amounts here to 4.0-0.25 °/oo. (3) Reaches of limnophilous fauna (rheophilous animals occur here only in some places, e. g., bays of bridges, stone dams, etc.). The unitary gradients are 0.25-0.0 °/oo. As we see, the distribution of the invertebrate fauna is not in perfect accordance with the distribution of plants. The occurrence of the limnophilous fauna does not strictly coincide with that of the macrophytes. In the rivers of Western and Central Europe four fish zones are distinctly marked: (1) The trout (Salmo trutta) zone, at the unitary gradient of 80-1,5 °/oo. (2) The grayling (Thymallus thymallus) zone, at the unitary gradient of 8.0-1 °/oo. (3) The barbel (Barbus barbus) zone, at the unitary gradient of 4.0-0,25 °/oo. (4) The bream (Abramis brama) zone, at the unitary gradient of 1.5-0.0 °/oo. The zone of the Salmonidae (trout and grayling) may be divided into three parts: (1) In streams, 0.5-5 m wide, it occurs at unitary gradients ranging from 80 to 8 °/oo. (2) In small rivers, 5-25 m wide, it stretches at unitary gradients of 16-1.5 °/oo. (3) In larger rivers, 25-100 m wide, it occurs at unitary gradients of 6-1 °/oo. From this general scheme there are deviations in the rivers of some geographical areas; they relate to the composition of ichthyofauna as well as to the range of gradients in particular zones. (From auth. summ.)

2515. Stroud, R. H. 1958. SUPER-INSECTICIDES--SPACE-AGE POLLUTANTS. Bull. Sport Fishing Inst., No. 74, pp. 1-2. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8899. 1959.

The Department of Agriculture's fire ant eradication program calls for distribution of 2 lbs/acre of dieldrin and heptachlor to more than 20 million acres of land in the southeast. Danger of destruction of other kinds of animals, is pointed out, backed by data from experimental studies. In one, dieldrin distributed at only 1 lb/acre in Florida marshes resulted in substantially complete kill of fishes and crabs, including baby tarpon utilizing the salt marshes as nursing grounds. In addition to fish and wildlife damage, there is possibility of increase of pest insects whose natural enemies are destroyed, and the possibility, that despite all, the fire ant will not be eradicated. "Important as the purpose is (fire ant eradication) it is not important enough to risk destroying priceless fish and other wildlife in at least five states. Apparent ignorance (lack of adequate research) and poor planning (disregard for other equally vital assets) seem responsible. , . . . Ironclad safeguards are needed to prevent fearsome pollution of water and land habitat and to protect sport fishing in particular. Nationally, the sport fisheries support a $2 billions sport fishing industry. Well over $500 millions of this are generated in the threatened states." (L. F. S.)

2516. Tamari, Tatuo, and Toyotake Tanoue. 1955. STUDIES ON THE RELATION BETWEEN THE FLUCTUATION IN CATCH AND THE ENVIRONMENTAL FACTORS OF THE PRINCIPAL FISHES IN KAGOSHIMA BAY. II. IN THE FISHERIES OF "ISTIOPHORUS ORIENTALIS (TEMINCK AND SCHLEGEL)" AND SEA CONDITIONS. Mem. Fac. Fish Kagoshima Univ., No. 4, pp. 20-24. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8905. 1959.

On the relation between the fluctuation in the catch of sail-fish and the sea conditions in Kagoshima Bay the following results were obtained. Fishing season in the mouth of bay was confined within the term from August to November, and at the inside of bay from September and October. The more dominant the mixing ratio of oceanic water became, the more possible it became for sailfish to migrate into the inside of bay in September. The winter temperature and salinity in the season of maximum catch lay within 23-29°C, 29-33.7% respectively at the surface and 20-25°C, 33-34.5% at the 50m layer. The variation in body length lay within the range 140-200 cm, and the average size of the fish was in the range 150-170 cm.

2517. Whitney, Richard R. 1958. NUMBERS OF MATURE WALLEYES IN CLEAR LAKE, IOWA, 1952-3, AS ESTIMATED BY TAGGING. Iowa State Coll. Jour. Sci., Vol. 33, No. 1, pp. 55-79. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8913. 1959.

The number and rate of harvest of walleyes (Stizostedion vitreum vitreum) were determined. This lake in north central Iowa has an area of 3642 acres, is 5 miles long and about 2 miles wide. The maximum depth is about 20 feet; 15% of the lake exceeds 15 feet in depth. It is eutrophic with an abundant, varied warm-water fish population. Numbered strap tags were placed on the premaxilla of 2232 walleyes during the 1952 and 1953 spawning season. After spawning, walleyes apparently move to more vegetative areas. Angler returns indicated a harvest of 15.7% in 1952 and 6.3% in 1953. Population estimates were based on data acquired by netting operations. Data on mortality losses and composition of the walleye population in terms of sex, year groups, body length, etc., are given. (G. H. N.)

2518. Zocchi, Rodolfo. 1958. INSECTS INJURIOUS TO FISH CULTURE. (INSETTI DANNOSI IN PESCICOLTURA.) Boll. Pesca, Piscicolt. e Idrobiol., Vol. 12, No. 1, pp. 108-115. Biological Abstracts, Vol. 33, No. 3, Abst. No. 8919.

The author gives elementary accounts of the morphology and biology of several species of ichthyophagous insects, as well as a method of contollling them. (From auth. summ.)

2519. Hirata, Hachiro, and Shinjiro Kobayashi. 1956. DIURNAL RHYTHM OF THE FEEDING ACTIVITY OF GOLDFISH IN AUTUMN AND EARLY WINTER. Bull. Fac. Fish Hokkaido Univ., Vol. 7, No. 2, pp. 72-84. Biological Abstracts, Vol. 33, No. 3, Abst. No. 9332. 1959.

Using an automatic recording apparatus, the

diurnal rhythm of the feeding activity of goldfish was studied from autumn to early winter. The feeding activity is definitely restricted to daytime; beginning one or two hours before sunrise and reaching the maximum from about the 11th to the 15th hour and ending or 2 hours after sunset. The maximum in diurnal rhythm of the feeding activity is usually in the interval showing the highest water temperature. From autumn to early winter, the daily feeding frequency decreases gradually with the passage of days. Feedings before sunrise become rare after early November, and the feeding ceases with the time of sunset after late November. In Hakodate, the goldfish ceases to feed at water temperature below 8:5°C, and in early December, several days pass with no feeding or very feeble feeding. Daily frequency of feeding is highly variable. Even if the water temperature is apparently favorable for feeding, the diurnal rhythm of activity is distorted when the water temperature does not show a distinct diurnal rhythm which is high in the daytime and low in the night time. The solar radiant energy is an important factor influencing environmental temperature. When it varies during an entire daylight period with a very low value, the water temperature shows an indistinct rhythm without marked variations. The diurnal rhythm of the feeding activity may be greatly inhibited on such a day. When the atmospheric pressure falls sharply, the feeding activity may be severely distorted, its frequency being much decreased. However, even if the atmospheric pressure is low, it does not exert influence upon the feeding activity of the goldfish when the pressure varies monotonously through the whole day. The absolute value of each of the environmental factors and also the relative magnitude of the diurnal variation must be considered in a comprehensive analytical study of fish feeding behavior. (Auth. summ.)

2520. Jullien, A., and J. Ripplinger. 1957. PHYSIOLOGY OF THE FISH HEART AND ITS EXTRINSIC INNERVATION (PHYSIOLOGIE DU COEUR DES POISSONS ET DE SON INNERVATION). Ann. Scient. Univ. Besancon Zool. et Physiol., 1957 No. 9, pp. 35-92. Biological Abstracts, Vol. 33, No. 3, Abst. No. 9392. 1959.

The middle primum of ten fishes (10 marine, 9 fresh-water spp.) is located in the auricle at the level of the sino-auricular valves. One wave of impulses passes to the auricular myocardium, another to the ventricle. Vagus inhibition is the result of two different types of fibers in the vagus nerve; one set alters the excitability of the myocardium, the other alters elongation of cardiac fibers. Acetylcholine does not seem to be the mediator of cardio-inhibitor impulses. (R. W. P.)

2521. Domurat, J. 1956. EMBRYONIC DEVELOPMENT OF TROUT (SALMO TRUTTA L.), PIKE (ESOX LUCIUS L.) AND ROACH (RUTILUS RUTILUS L.) IN AN ENVIRONMENT DEPRIVED OF WATER. (ROZWOJ EMBRIONALNY TROCI (SALMO TRUTTA L.), SZCZUPAKA (ESOX LUCIUS L.) O PLOCI (RUTILUS RUTILUS L.) W SRODOWISKU BEZWODNYM.) Polski Arch. Hydrobiol., No. 3, pp. 167-173. Biological Abstracts, Vol. 33, No. 3, Abst. No. 10302. 1959.

Embryonic development of trout (S. trutta L.), pike (E. lucius L.) and roach (R. rutilus L.) in paraffin oil was studied. It was demonstrated that development from the stage of first blastomers can occur in this environment in all examined species, but hatching of larvae was observed only in the roach (5%) The length of hatched larvae did not differ from the length of the control larvae developing in water. After hatching the larvae were put in water in which they lived only 36 hours. (Auth. summ.)

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